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Kuparuk

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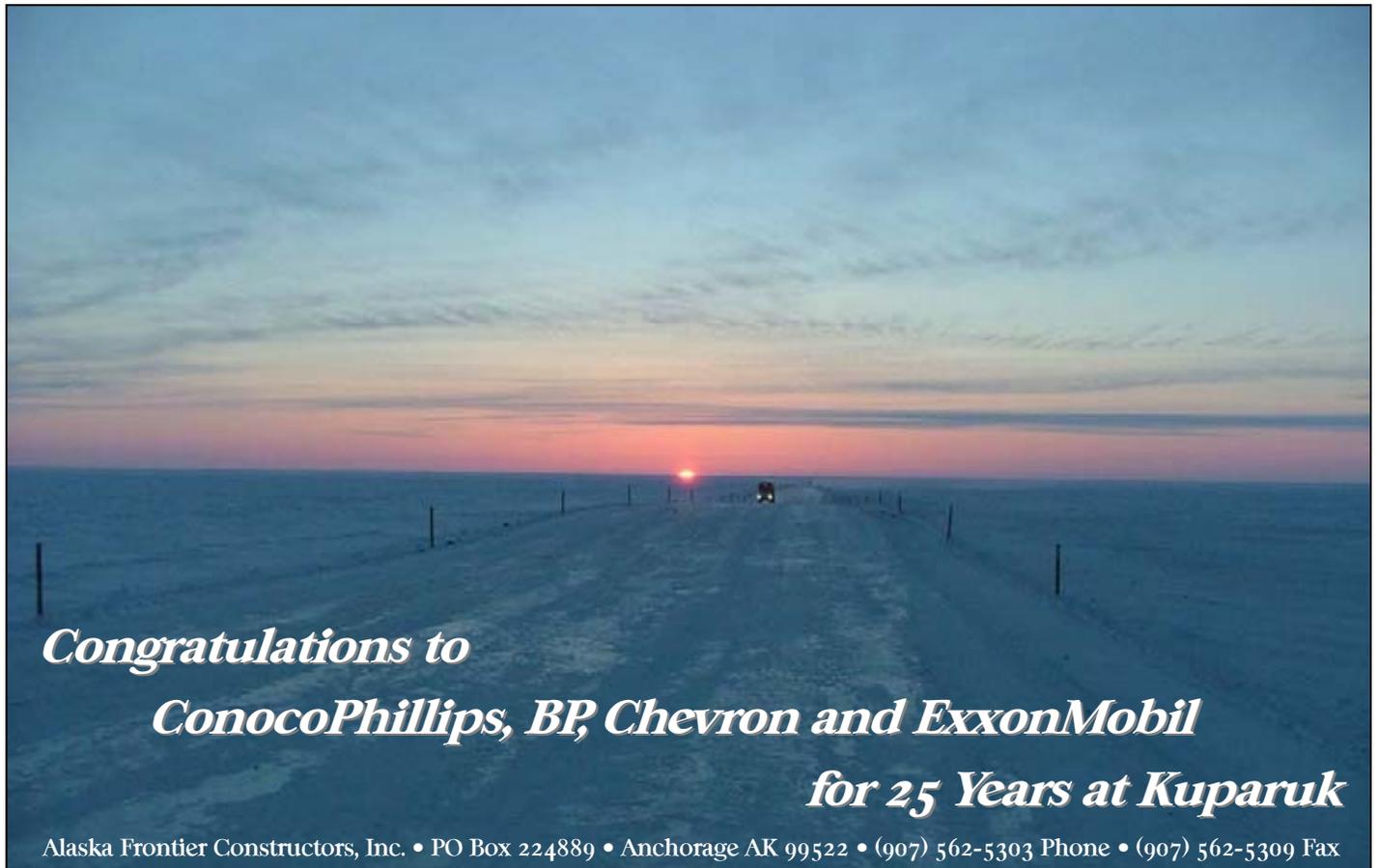
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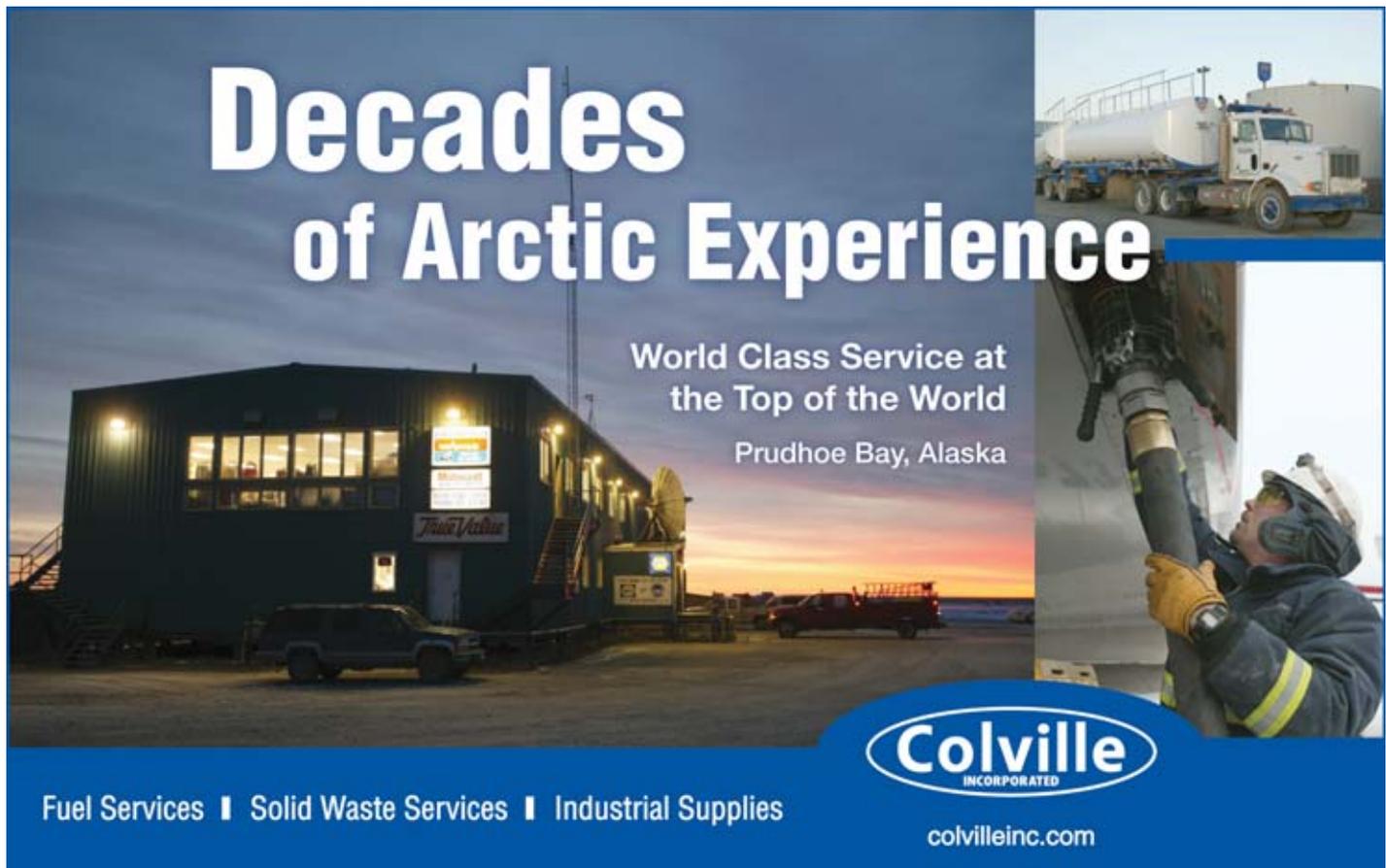
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A message from Jim Bowles

President, ConocoPhillips Alaska

Please join me in congratulating Kuparuk on the occasion of its 25th anniversary. The first production from the Kuparuk Oil Field took place on December 13, 1981. Though it was once thought to be a marginal field, Kuparuk went on to surpass its 2 billion barrels produced milestone and is still going strong. Kuparuk's history and current operations are distinguished by technology, environmental stewardship and the dedicated people who work in the field.

After the investment of 25 years of technology and innovation, the Kuparuk field has proven to be a legacy asset. Over time, the infrastructure has expanded and we've been successful in developing additional production from the smaller satellite fields of Tarn, Tabasco, Meltwater, and West Sak.

It's exciting to think that Kuparuk has only reached the midpoint and now we're working on the next 25 years. Kuparuk has long been a pioneer in the development of new technology and a leader in environmental stewardship.

In 1999, the Kuparuk River Unit was presented with the Environmental Protection Agency Award for Pollution Prevention. This was the first time such a prestigious award was given to an Alaska company and it was the first time the award was given to an oil field.

Kuparuk went on to receive the Interstate Oil and Gas Compact Commission Environmental Stewardship award, and become a proud member of the Alaska Green Star program. These national and local recognitions are all symbols of the outstanding efforts by our employees and contractors who have made environmental consciousness part of daily routine at Kuparuk. This grassroots effort has grown and evolved to include ConocoPhillips' support of conservation and access programs supporting key fish and wildlife habitats in



Alaska.

In addition, Kuparuk has led the way in the arctic technology that has enhanced the field's recoverable resources far beyond what was predicted at startup. These new technologies that have been instrumental in the development of the area viscous oil resources. Kuparuk's future plans include the continued development of the large West Sak heavy oil satellite, the redevelopment of the Kuparuk "A" sands using coiled tubing and extended reach drilling technologies, and another look at the Ugnu development.

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JUDY PATRICK

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Kuparuk by the numbers

Camps

Peak occupancy	1,208
Beds available	1,279 (KOC 551, KCC 643 and KIC 80)
Avg. daily occupancy (1998)	1,042
Offices on KOC pad	298
Hallways	2 miles in main camp area

Dining

Dinners served (weekly)	5,500
Breakfasts served (weekly)	3,600
Donuts and pastries (weekly)	25,000
Sandwiches (weekly)	14,000
Potatoes (weekly)	1 ton
Apples (weekly)	1/2 ton
Bananas (weekly)	1 ton
Watermelon (weekly)	1/2 ton
Milk (weekly)	900 gallons

Eggs (weekly)	9,600 (800 dozen)
Cups of coffee and juice (weekly)	52,000
Prime rib (one meal)	850 pounds
Steak (one meal)	600 pounds
Total food per day	4 1/2 tons (shipping weight)

Roads & Pads

Pick-ups	319
Heavy equipment	125
Non-mobile	299
Tires replaced (annually)	1,500
Windshields replaced (annually)	232
15/40 motor oil	38,700 gallons
Vehicle PM's w/oil change	10,327
Gallons of diesel used (annually)	7.8 million gallons
Miles of roads	123
Acres of gravel pad	852

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BOWLES

I'm sure there are many stories about Kuparuk, but there seems to be a common thread through our history, that's our people. With an average winter population of more than 1,200 workers, Kuparuk has become its own community whose people reach out across this great state. Each year the field generates thousands of Alaska jobs and millions in state revenues, which benefit every Alaskan and

support the communities where we live.

I'm proud of their commitment to safety and this year Kuparuk will receive its OSHA VPP Star certification for those efforts. Many of the people who work at Kuparuk are your neighbors. They volunteer their time and energy at home as well as work. It's the dedication of these men and women that make me so optimistic about the next 25 years.

Our past, present, and future successes are a result of the innovation, commitment and passion shared by these men and women.



ConocoPhillips

Kuparuk 25

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PETROLEUM NEWS

PO Box 231651
Anchorage, AK 99523-1651
Phone: (907) 522-9469
Fax: (907) 522-9583
www.petroleumnews.com

Petroleum News magazine staff

KAY CASHMAN • Publisher & Executive Editor
MARY LASLEY • Chief Financial Officer
KRISTEN NELSON • Editor-in-chief
SUSAN CRANE • Advertising Director
STEVEN MERRITT • Production Director
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At 25, Kuparuk at midpoint

Field began producing in December 1981, has conventional resources, vast amounts of viscous oil yet to develop

By **KRISTEN NELSON**
Petroleum News

The Kuparuk River field has been in production for more than 25 years, since Dec. 13, 1981.

It has a lot more anniversaries to go.

"We don't feel we're halfway through the field's life yet, even though we're at the 25-year anniversary," says Paul Dubuisson, manager of North Slope operations for Conoco Phillips Alaska.

Jim Bowles, president of ConocoPhillips Alaska, said: "Today the field continues to be an important legacy asset to our company."

"Kuparuk has played a key role in the development of ConocoPhillips' technology in many areas," Bowles said. "Our key to long-term growth at Greater Kuparuk will be found in the development of the heavy and viscous oils found at West Sak and the Ugnu."

Georg Storaker, ConocoPhillips Alaska vice president of operations and development, said "Kuparuk is far from retirement."

"Leadership in innovation and expanding the use of today's technology could lead to the redevelopment of the Kuparuk 'A' Sands using coiled tubing and extended reach drilling technologies.

"There are more opportunities on the



Three rigs, two Doyon and one Nordic, drilling West Sak wells at 1J pad in September 2006.

horizon," Storaker said.

Kuparuk continues to expand

"Like most large fields it continues to expand," Dubuisson said. There's "a lot of potential" in both the West Sak viscous oil and the older, more conventional reservoirs at Kuparuk. Technology has unlocked "a tremendous amount — but there's even more there."

That future lies in two areas, Dubuisson said: infill drilling and

enhanced oil recovery in the existing Kuparuk production conventional oil production.

Three-D seismic shot at the field two winters ago allowed the company to identify "quite a bit" of development potential in the existing field, he said, places where the waterflood and enhanced oil recovery project can be fine tuned, based on "knowing more about the geology from the 3-D seismic."

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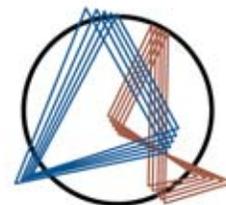
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MIDPOINT

The 3-D also identified more than 100 infill locations which can be drilled over the next four or five years, some of that around satellites.

The other area is heavy oil, with billions of barrels of West Sak and Ugnu known, because ConocoPhillips drills through those shallower accommodations to reach Kuparuk oil.

Van Lineberger, ConocoPhillips' Greater Kuparuk operations manager, said that in addition to two Doyon rigs, there are two Nordic rigs at Kuparuk. One of the Nordic rigs is "coiled tubing drilling" capable, another "new emerging technology which really helps us exploit the reservoir," he said. Coiled tubing allows the company to "relatively inexpensively, very quickly go in and take advantage of some of the new seismic results and further develop the Kuparuk field," Lineberger said.

More water injection will probably be required at Kuparuk because with declining oil production "the total fluid production tends to go up because of the water you produce along with the oil," Dubuisson said.

"So I think we'll probably be installing additional water injection capacity over time." Additional power will probably also be needed in Kuparuk's existing facilities over time.

Viscous development 'well into the future'

But the long-term future at Kuparuk is the West Sak formation.

"Obviously the big development, well into the future, is the ... viscous oil."

West Sak development is under way at Kuparuk, and that development could move "further up in the West Sak to the shallower, colder oils." Above West Sak lies Ugnu, which is heavier still, and Dubuisson said a lot of technology needs to be developed to produce Ugnu, "but certainly you can envision it in the future," although there is no timetable for Ugnu.

"We're working the technologies now. ... You have to do a lot of work to decide how it would be possible to produce it."

But at West Sak the change has been dramatic.

"We brought on another well yesterday (Dec. 10) making about 3,000 barrels a day. ... It wasn't that long ago it would have been a couple hundred barrels a

day."

Lineberger was working for Conoco at Milne Point in the early 1990s, when they were just starting to develop the West Sak equivalent, Schrader Bluff.

"And if we had a 500-barrel-a-day well, we were ecstatic," Lineberger said. "Today, 5,000 barrels a day is not uncommon for some of the initial rates we get from these tri-lateral West Sak wells."

Technologies such as horizontal drilling, multi-lateral drilling and learning to manage solids have pushed us toward a great future in West Sak, he said.

ConocoPhillips has two rigs working on the 1-J pad right now, Dubuisson said, Doyon 15 and 141.

Pad 1-J is the new pad focused on West Sak production, he said. Pad 1-E, with a lot of Kuparuk production, is also part of overall West Sak development, while 1-J is essentially a "fully dedicated West Sak drill site."

Sand management good

Sand production has been one of the problems with West Sak and similar reservoirs because they are shallower, softer sandstones, not as well consolidated as deeper formations. When the oil is pro-

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MIDPOINT

duced, a lot of sand comes with it.

Dubuisson said he was with Conoco before the Milne Point field was sold to BP. He wasn't working on Milne, but was in Houston when the company started developing the Schrader Bluff formation there some 15 years ago.

"And they told me that they were producing a lot of sand from these wells. I said that's impossible — you can't produce that for very long."

"We've gotten very good at managing it," Dubuisson said. "The wells produce some sand initially when you bring them on, but as you clean them up, the way we've evolved cleaning up the wells, it goes back to just a very small background level."

Initially there is a good deal of sand production, he said. The laterals on the wells "are so long, because you're exposing so much of the reservoir ... as you clean those out from the drilling process you get a good bit of sand back."

ConocoPhillips has installed facilities to clean the sand out of the separators, the equipment that separates the oil from the water and gas produced with it. "We can clean out the separators from the sand we see there ... while we're producing."

That's been a learning process over the last two years. Initially "we'd bring a new well on and would see large amounts of sand ... for a short period of time; and here lately it's a one- or two-day event."

Lineberger said ConocoPhillips has "been able to handle the solids that are associated with the West Sak production with minimal production impacts. ... And we're continuing to look at technologies that will make life better," he said, such as hydro-cyclones and centrifuges, which provide "an enhanced separation process which helps separate oil, water and solids."

Facilities operation key

The facilities, however, were designed for light oil.

It's "a testament to the quality of the folks you have there," Dubuisson said: "They've taken facilities that were designed for light oil, and we've made some modification, but really it's been in the way they operate them that they're able to handle that viscous oil without really any significant difficulty."

Lineberger said ConocoPhillips is negotiating commercial agreements with some third parties — Pioneer, Anadarko — "to utilize available capacity within our infrastructure, which is good for everybody."

Major facilities at Kuparuk include three central processing facilities, the seawater treatment plant, pipelines and pads.

47 active drill sites, 2.2 billion in production

There are 47 active drill sites and approximately 1,100 wells at Kuparuk, about half producers and half injection wells, Dubuisson said.

Alaska Oil and Gas Conservation

Commission records show that, through the end of November 2006, Kuparuk has produced almost 2.2 billion barrels of oil: 2.1 billion barrels from the Kuparuk River pool; 79.1 million barrels from Tarn; 25.9 million barrels from West Sak; 12.6 million barrels from Tabasco; 11.1 million barrels from Meltwater; and 1,606 barrels from Ugnu.

The Alaska Division of Oil and Gas lists five participating areas in the Kuparuk River unit: Kuparuk, the main producing formation at the field, was discovered in 1969 and produces from the lower Cretaceous Kuparuk formation at about 5,600 feet subsea.

West Sak, discovered in 1971, produces from the upper Cretaceous West Sak Sands at about 3,500 feet subsea.

Tabasco, discovered in 1986, produces from the middle Cretaceous Nanushuk Group Tabasco Sand at approximately 3,000 feet subsea.

Tarn, discovered in 1991, produces from the middle Cretaceous Seabee formation Bermuda Sand at 4,376 to 5,990 feet.

Meltwater, discovered in 2000, produces from the middle Cretaceous Seabee formation Bermuda/Cairn Sands.

Another discovery, Palm, made in 2001, is a Kuparuk C4 interval found to be in communication with the main Kuparuk reservoir and developed from a new Kuparuk pad, 3-S, which came online in November 2003.

Core area working interest owners at Kuparuk are ConocoPhillips, 52.12468 percent; BP Exploration, 37.02472 percent; ExxonMobil 5.8 percent; and Unocal 4.9506 percent.

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A remarkable workforce

Dubuisson: workforce 'unique'; Lineberger: they 'just find ways to get things done'

By **KRISTEN NELSON**
Petroleum News

Both Paul Dubuisson, manager of North Slope operations for ConocoPhillips Alaska, and Van Lineberger, ConocoPhillips' Greater Kuparuk operations manager, use the word remarkable when talking about Kuparuk.

And both are talking about the remarkable people who have worked at the field over the last 25 years.

Dubuisson, who's been at Kuparuk for two and a half years, says the people who work for the company at Kuparuk are what strikes him the most: "It's a remarkable workforce."

"I think it's unique, in the places that we operate around the world, in terms of the talent and the experience and the camaraderie."

"It's a very demanding environment; it's an unusual location.

"We have essentially a self-contained city up there. And the fact that it's been there for 25 years is quite an accomplishment."



JUDY PATRICK

Lineberger says "it's been a pretty remarkable 25 years" at Kuparuk.

"It's amazing that in the early days it was viewed as a marginal development. What I

describe as the Kuparuk SPIRIT really kicked in, which has brought about innovations and applications of technology that

see **WORKFORCE** page 12

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JUDY PATRICK



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WORKFORCE

have really brought us to the point where we're 25 years old and we don't think we're half-way done."

Lineberger said the cornerstone at Kuparuk is "the employees, both company and contract." He said they "just find ways to get things done, find ways to make things better, find ways to really develop a strong future, both for themselves and as a place for their children to work."

Georg Storaker, ConocoPhillips Alaska vice president of operations and development, agrees.

"There have been many milestones at Kuparuk over 25 years," he said. "These included: producing more than 2 billion barrels; receiving the EPA Evergreen Award; the IOGCC Environmental Stewardship Award and the development of the West Sak.

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Quality, passion of Kuparuk people

- Vicky Hahn, now at Alpine, was at Kuparuk from 1989 to 2000, with an 11-month hiatus in town before she was able to swap jobs with a slope mom who wanted to be home with her son.

Hahn says the people were the most memorable thing.

And the project she's most proud of was not "position related," Hahn says, but part of her volunteer work at Kuparuk.

"I sat at the Cirque well blow-out in a Fire response vehicle for a week as a member of the Fire Brigade (it's since grown up to be a department). Fortunately," she related, "that all ended without need for our emergency assistance."

- "The people at Kuparuk made going to work everyday fun," said Joe Leone, who was vice president for the Greater Kuparuk Business Unit, 1998-2003, and is now vice president upstream technology for ConocoPhillips in Houston. "The hourly workforce is highly skilled and experienced, and the technical and support staffs are amongst the best in ConocoPhillips," he said in an e-mail.

"There is a great deal of pride in being part of Kuparuk and in supporting the community.

"There is also a sense of togetherness that was great to be a part of," Leone said.

- Jerry McGarry, who worked at Kuparuk with HSE from 2000-2006, and is now at the Kenai LNG plant, said what was most memorable

about working at Kuparuk was "the relationships developed with people from all sorts of different backgrounds and experience."

"They challenged and stretched me in many ways. I will never forget the times of seriousness as well as the times of laughter from the people that made my time away from my family enjoyable," McGarry said.

- Alan Schuyler worked at Kuparuk from 1984 to 1996, and is now HSE manager at ConocoPhillips Long Beach JV.

"The quality, integrity and passion of the people who worked and lived at Kuparuk," was most memorable, he said.

"I felt that the entire community became your extended family, particularly around the holidays. I

remember it as a wonderful place to work. ..."

- Jim Short, who worked Kuparuk — and at Kuparuk — from 1980 to 1989, in permitting, environmental and safety, and is now at Alpine, said what is memorable to him about Kuparuk is "the professionalism and expertise of the workforce" and "the focus on safety, environmental protection and production goals."

He also listed "their understanding and appreciation of their great responsibilities." He said "the friendly atmosphere" was "like having several hundred of your best friends in one place."

- Barbara Byrne VanderWende

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Kuparuk25



Stories from the field

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PEOPLE

worked on summer studies at Kuparuk beginning in 1986, and was assigned to the field as senior environmental coordinator from 1990-97.

She is now an environmental consultant and lives in River Bend, Mont.

“After I retired, I worked two winters for Anadarko on an exploratory well south of DS 2K. We were based out of Kuparuk during the construction and mobilization phase. Independents do not have the infrastructure that the North Slope operators have and it is often more difficult to get your job done. I will always remember the willingness of my Kuparuk family to help me and the Anadarko team out when we hit a snag.”

And sometimes the help

went to total strangers, such as the spring the Kuparuk River washed out earlier than expected, stranding a young couple and their 6-week old daughter on the Kuparuk side. He was a doctoral student collecting spring migration data on caribou. The young family couldn’t even drive into Kuparuk “as they only had enough gas to get them back to Deadhorse when the bridge was back in.”

VanderWende related that Moose Cunningham, the roads and pads supervisor, found them when he was doing a road inspection.

“We brought them to camp, arranged for showers and food. They were very nice and, of course, grateful. We had some baby formula shipped up from town for them. I’m sure they will always remember the friendly Kuparuk people.”

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“However, these milestones could only be achieved with the dedication and performance from the men and women of Kuparuk. I want to thank everyone who has been a part of Kuparuk’s history and I’m proud to be a part of such an outstanding team for the future,” Storaker said.

No staleness here

Dubuisson said he was also struck by the innovation.

When he first got to the field, he said he wondered if people who’d been working at any one location for 20-plus years might be stale.

“Nothing could be further from the truth. These folks are really energized at what they’re doing,” he said.

And “whether it’s taking these light oil facilities and trying to figure out how to make viscous oil with them, or whether it’s trying to do any of

hundreds of other things a little bit differently and better, everybody up there is just energized in terms of their jobs.”

People have come to enjoy the lifestyle of one or two weeks on, one or two weeks off. “They work their one or two weeks, sometimes more, and they work very long hours. And they really enjoy their jobs — but then they like their off-time, too,” he said.

About 70 percent work two weeks on and two weeks off.

There are about 1,100 people working at Kuparuk, 350-400 of them company people. “About 200 on site” at one time, Dubuisson said, running the processing facilities, the seawater treatment plant, the wells and the “city.” Contractors include cooks, security, catering, equipment operators, technicians, engineers, designers, roustabouts, insulators and inspection crews. Dubuisson said there are currently about 110 contractors just working inspections.

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Work year-round

Seasonal work includes ice roads and some inspection work in the winter when it's acceptable to travel on the tundra. "But apart from that, if you're connected to the road system it's year-round. It's just for shorter periods of time in the winter."

But although the work is year-round, the extreme weather in the winter is a factor in outdoor work.

Dubuisson said that "depending on what the temperature is, we limit exposures."

At a certain ambient temperature (minus 35 Fahrenheit) or wind chill (minus 50 F), "people may be limited to 30 minute outside work intervals" and special permits are required to operate heavy equipment.

In addition to activity restrictions based on the weather, "you monitor what people wear," such as making sure people are wearing face masks.

Winter visibility is also a factor, with travel restrictions and convoy policies as visibility decreases, in three phases.

People aren't allowed to stop on a road, so that eliminates roadside work.

"And as the visibility decreases you mandate that in phase 2 you have to have convoys and you restrict the work that's done to essential work. And then phase 3 is essentially a whiteout condition and it's only emergency travel and convoys have to be led by a heavy piece of equipment like a bulldozer," he said.

Volunteers play a crucial role

Volunteers — both ConocoPhillips



JUDY PATRICK

along with a technician and an aide, support the volunteer organization.

Everybody else is a volunteer, he said. The spill response organization, less a couple of ACS employees, is also voluntary.

Supervisors on the slope work with employees to allow them to participate in training, and that "includes both company and contractor — no distinction there," Lineberger said.

The bulk of the people, "when you're talking about a response, even a drill, 5 percent are dedicated employees, the rest are all volunteers," said Ken Donajkowski, ConocoPhillips Alaska's vice president of health, safety and environment.

"We have volunteer response groups on the slope, so our fire response and medical response and our spill response are all staffed primarily by volunteers. These are people that are willing to put some extra effort and energy into being responders.

"And they do a great job," Donajkowski said.

Staying fit and recreating

And what else do people do in their off-time at Kuparuk?

The field has exercise facilities so that people can stay fit in their off time, Lineberger said.

"There's an archery club ... a ham radio club ... (and) volunteers arrange and hold worship services on the weekend.

"There's no hunting, but people fish," all catch and release, Lineberger said.

And there are fun runs every summer hosted by the different facilities.

employees and contractors — keep Kuparuk's emergency services running.

Lineberger said the emergency response organization has chiefs who oversee the fire brigade and the spill response team. Kuparuk is also affiliated with Alaska Clean Seas, and uses some of their technicians to help with Kuparuk preparedness, he said.

"The fire brigade is roughly 75 strong," Lineberger said. That's what it takes to field 25 people, "so by having 75 on the team we're able to meet our minimums."

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Kuparuk safety continues to improve

Paul Dubuisson, ConocoPhillips Alaska's North Slope operations manager, says safety is part of the culture at Kuparuk.

"An example is what we call intervention," he said, and it's something you see pretty frequently.

Someone notices something that "isn't quite right and they take it on as their personal responsibility to intervene and see if there's some better way to do things." It may be "a contractor stopping a company employee or a company employee stopping a contractor employee" or workers from entirely different work groups. "It starts with the motto 'nothing is so urgent or important that we can't take the time to do it safely,'" he said.

The work place is the safer for it.

"2005 was the seventh consecutive best year ever for us on our safety performance" at Kuparuk, Dubuisson said.

And it's not just the number of incidents: "We know that the severity of incidents has decreased quite a bit over the years," he said.

The logo has been "road to zero, with a six in the middle of it (in 2004) and ... a seven last year.

"I know the folks up there are proud of that — and they should be, because it takes a lot of effort," Dubuisson said.

Workforce engaged in safety

Van Lineberger, ConocoPhillips' Greater Kuparuk operations manager, said the company is "hoping for continuous improvement from a safety performance standpoint. We have a very engaged workforce trying to eliminate workplace injuries at Kuparuk.

"That's what makes me most proud," he said, "... that spirit and resulting effort that strives to send everyone home safely."



It's particularly remarkable in 2006, Lineberger said, because "this has been a year in which we've seen a tremendous, tremendous strain on our resources," driven by high oil prices and other activity on the North Slope. That has brought a lot of new people into the industry, and yet safety performance, he said, continues to be good.

One thing that guests frequently comment on is how clean it is at the field, Dubuisson said. "They've accused me ... of going through facilities and cleaning them beforehand." He says he's gotten that comment about both inside and outside, but inside the facilities is where he most often gets that comment.

Not so: it's the norm, he says.

—Kristen Nelson

Safety culture has grown over time

Improved worker safety was one subject employees talked about in the 20th anniversary video the company produced in 2001.

- Steve Kruse, talking about his time as a superintendent at CPF-3, said there were no lost-time accidents at the facility the last three years he was there. The facility "went through a major turn-around and I think that was really the most rewarding experience, getting the safety culture, where we weren't hurting anybody."

- Richard Sloan, who first saw Kuparuk when he was hired by ARCO in May of 1981, said one of the most fulfilling events he remembers was in 1997 when they took all the vessels down: "It was a major shutdown. We had to take down the primary separators for internal cleanup. ... We had a lot of construction people involved and we were really focusing on the safety effort and schedule, of course, because the big vessels were out."

Everything seemed to "click really well," Sloan said. "I found it most rewarding, in the sense that all facets — the contract people, the operating people — were all working toward a common objective and ... it came off on schedule

Kuparuk25



Stories from the field

see SAFETY page 16



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Environmental studies from the get-go

Company has been studying wildlife at Kuparuk since development days; swans targeted, caribou also a focus

By **KRISTEN NELSON**
Petroleum News

Caryn Rea, senior staff biologist for ConocoPhillips Alaska, says there's always been a biologist with the company — starting in ARCO days — on the North Slope. In the 1970s it was Angus Gavin, who “did a lot of initial work on the North Slope in conjunction with (U.S.) Fish and Wildlife Service biologists and others.”

At Kuparuk, the company has studied swans since the days of field construction. “ARCO did a number of studies looking at swan distribution within the proposed footprint of Kuparuk” because swans are relatively sensitive to disturbance and “we wanted to avoid areas near swan nests, as much as we could,” Rea said.

Swan monitoring has continued at Kuparuk, and the company does swan surveys in any area proposed for new development and continues the surveys after development.

The studies look at before and after, “the number of swans that are occupying the



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fields before you build and then you continue monitoring after.” The company is “not seeing any significant impacts to the numbers of swans returning to Kuparuk.” What they do see, she said, is natural variability — some years with higher counts of swan nests than others.

There are a lot of birds that use the Kuparuk area for nesting, but “we use the swans as an indicator species of the overall health of water bird and shorebird communities using the oil fields.”

“We’ve targeted tundra swans. . . . You

see **WILDLIFE** page 18

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SAFETY

and without any injuries.”

Sloan said he could remember programs in years past “to entice us to be safe and people would rise to those occasions . . . but you really didn’t ever hear people talking about it before the jobs.”

People now, he said, “have an expectation that they can do the job safely. I think that’s different.”

“And it wasn’t something that was happening immediately; it wasn’t happening as a focus — in my opinion — of any singular event.”

What happened over time, he said, was a considerable change in perspective.

“I guess I found that rewarding — when the people felt comfortable that they could come forward and I felt like they were engaged in safety, we were successful.”

• Jerry McGarry, who was at Kuparuk with HSE from 2000 to 2006, and is now at

the Kenai LNG plant, noted the safety culture in responding to 2006 e-mail questions about working at Kuparuk.

“I think the biggest change was the emphasis on reducing safety and environmentally related incidents — moving to a Zero Incident Culture,” McGarry said. “This effort was supported from top management and permeated the entire work force. The result was a continuous improvement each of the six years I was involved with the Kuparuk asset, an accomplishment to be very proud of.”

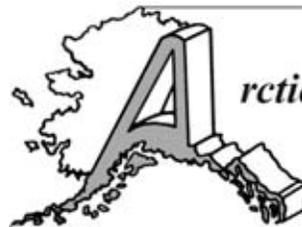


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Celebrating 25 Years at Kuparuk!

FMC Technologies



continued from page 16

WILDLIFE

can spot them from the air, they mate for life and ... they come back to the same region year after year.”

People who work at Kuparuk are interested in the swans. Five satellite transmitters have been placed on swans, Rea said, and “the idea is to get a Web site up so people in Kuparuk can watch when the swans leave Kuparuk and travel cross country into the Carolinas.”

Caribou work expanded to Alpine

Early caribou surveys at Kuparuk were done by the Alaska Department of Fish and Game, Rea said, and then in the early 1990s the company took up that work, and has “been conducting annual surveys on caribou.”

The surveys used to be right after calving in late June, and then through July and August.

ConocoPhillips has expanded the program, she said: “We fly surveys before calving (and) after calving. We call these lifecycle periods that we try to capture because the behavior of caribou is different during the different cycles.”

In late June, after calving, the caribou are harassed by mosquitoes, “and so the concerns of agencies have been that the caribou can get to the coast.” Rea said studies have documented that caribou can get through the field to the coast, as well as documenting that caribou can get under the pipelines and move across roads.

“There have been 20 years of studies,” she said, and when documentation began the central arctic caribou herd was some



JUDY PATRICK

7,000; now it is more than 30,000.

The company has a number of fact sheets on North Slope birds and animals available on its Web page at www.conocophillipsalaska.com/environmental/.

Workers alerted when caribou return to field

Environmental alerts are issued to workers each year at the beginning of summer when caribou return to the Kuparuk field.

About three weeks after calving the cows and their calves start moving through the field “and environmental compliance folks have always put out environmental alerts” and people slow down.

When Meltwater (south of Kuparuk) was under construction the company tried

convoing traffic to see if that would minimize caribou disturbance “and it really didn’t pan out for us, but we tried it.”

The best solution seems to be to have vehicles slow down, she said. “The caribou will cross the road and go under the pipelines.”

Rea said the company has recently increased the height of new pipelines to an average of seven feet above the tundra. “Some of the central arctic animals stick around the oil fields in the winter,” and the increased height allows for snow.

Before the gravel hits the ground

The company begins gathering data in advance of development so agencies have

see **WILDLIFE** page 19

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From left, Tim Wood, Steve Stuart, & Owen Boyle

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continued from page 18

WILDLIFE

enough information “to do a sufficient analysis of potential impacts and it also gives us the information so that we can work with our project teams.” The studies group then works with the engineers as they are laying out roads and pads. “If we can shift a road or change the orientation of the pad because of some sensitive habitat we’ve identified, we try to do that.”

There is also “post-development monitoring of key species,” she said. That includes caribou and tundra swans. Spectacled eiders are also surveyed because they were listed under the Endangered Species Act in 1992.

“I’m guessing that Kuparuk has one of the best data sets for identifying preferred habitat for spectacled eiders on the North Slope.”

Hydrologists are on the ground in mid-May and caribou biologists start flying in May and then every couple of weeks thereafter. Bird and fisheries biologists arrive in June.

In addition, Kuparuk plays host to University of Alaska Fairbanks’ graduate students studying North Slope wildlife. “There’s been some work done on king eider breeding biology (and) there’s a project wrapping up now on ravens.”

The raven project has involved the whole field, she said, with guys at the production facilities telling the researcher raven stories. “They’re very aware of the ravens,” she said.

Also base for polar bear studies

Kuparuk is also a base for polar bear and grizzly bear studies. The pilot who surveys for grizzlies in the summer is based out of Kuparuk, Rea said.

And polar bear biologists were headed up to Kuparuk in mid-December to fly FLIR, forward-looking infrared, surveys.

The FLIR is mounted on the otter and “has been used in the past to look for polar bear dens because ... it can detect a heat signature.” That helps locate dens of bears that are not collared, and then U.S. Geological Survey biologists go out and confirm the den after the sow has left. It’s not 100 percent accurate, she said, but it’s a pretty good tool.

The biologists going up in December were with the U.S. Fish and Wildlife Service and USGS. They were going to fly over areas where ice roads are proposed, looking along riverbanks. Those are “prime habitat for polar bears” because of the drifted snow.

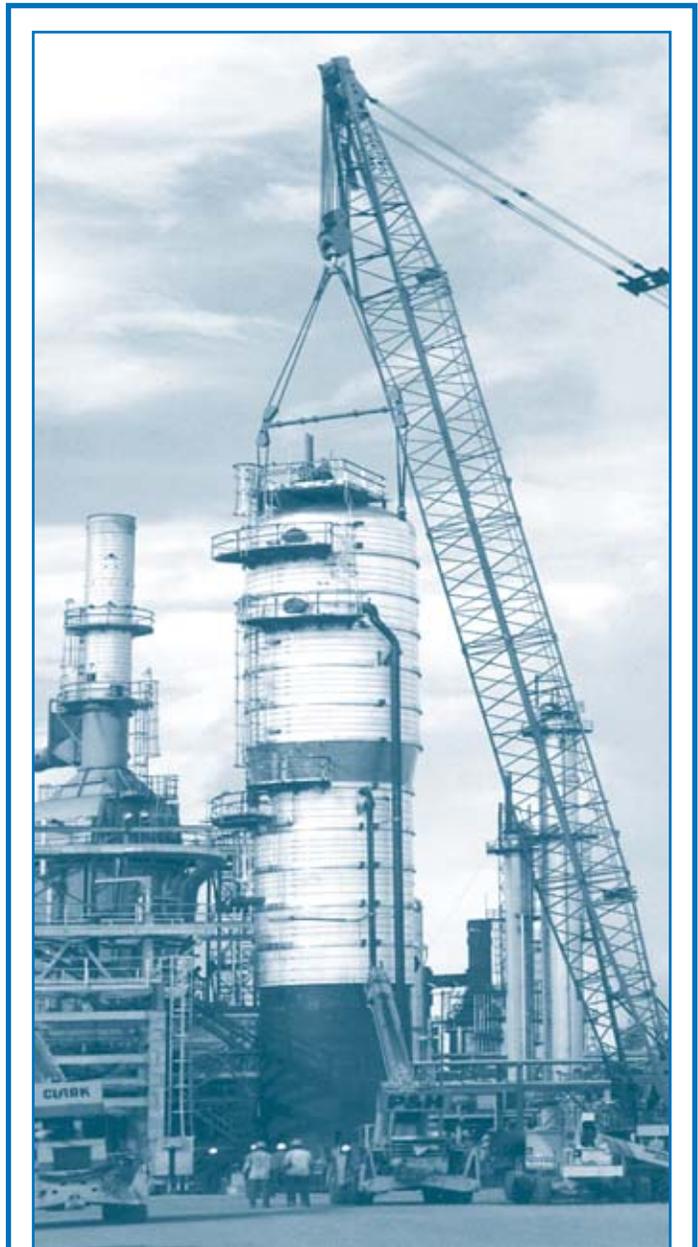
The environmental coordinators, depending on the time of year, will issue environmental alerts or attend safety tailgate meetings to remind people that this is the time polar bears are out, “so be aware and follow your polar bear avoidance plan.”

There are two environmental compliance positions at Kuparuk — four people because of the rotation — so there is nearly always environmental compliance staff on site.

Environmental compliance folks have been at Kuparuk since the beginning, she said, and this is the model that was used when Alpine was developed and that will be used in the National Petroleum Reserve-Alaska.

It’s not just studies, “environmental awareness is part of the culture,” Rea said.

The compliance people do permit compliance: “Any permit that is issued for Kuparuk, whether it’s air, storm water, they are responsible for compliance. ... Any permit we have, we’re responsible for complying with it, and so they educate whatever facility has an air permit, for instance, to make sure they understand what we need to do for reporting.”



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Kuparuk Earth Energy Partners recycled

Effort changes from recycling at field in the '90s to working with partners on statewide conservation projects

By KRISTEN NELSON
Petroleum News

Earth Energy Partners was formed in the early 1990s by Kuparuk River field employees to promote recycling, says Ken Donajkowski, ConocoPhillips Alaska vice president of health, safety and environment.

Recycling became a part of the Kuparuk culture, he said, and employees no longer needed Earth Energy Partners to focus their attention on recycling.

The program name has been recycled: Earth Energy Partners is now a ConocoPhillips partnership with external stakeholders.

Caryn Rea, ConocoPhillips Alaska senior staff biologist, describes the initial focus as "increasing the awareness of employees about waste reduction (and) waste recycling."

"This program has a little different focus," Rae said. "The original program, the waste reduction and recycling component of Earth Energy Partners, really took off in the field and it is now part of our culture. We are hoping to have this same reaction from employees with our new focus.

"The current Earth Energy Partners is looking to increase employee awareness of critters, access and conservation issues statewide," she said. "The program also provides opportunities to work cooperatively with environmental NGOs, as well as state and federal agencies."

Original program grassroots

"I know Alan Schuyler was a major player in this" effort to start recycling, Donajkowski said. "It was a grassroots consciousness effort on the part of employees — and that included contractors as well."

A core group started some recycling efforts and then, in an effort to get more people "just thinking about recycling activities and environmental improvements" they came up with the idea of an easy recognition process based on a little card. They called it a "good guy" program — they decided "guy" was generic enough to include both men and women, he said. The idea was to fill out a card recognizing a recycling effort, such as bringing newspapers from your room for recycling.

Rea said individual efforts included using the same lunch bag every day — or a mug instead of a throwaway Styrofoam cup.

The program grew from individuals to departments.

Donajkowski said one thing that got significant recognition was when people in the vehicle maintenance shop found information on recyclable filters for oil, made from metal in such a way that you didn't need a paper cartridge. You took the filters out, put them through a cleaning cycle and reinstalled them — you didn't have to throw them out.

He said some of what they did is "painfully obvious" now,

see **RECYCLING** page 21

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RECYCLING

“but in the early years it wasn’t.” Stainless steel valves were tossed out, until they found there was a way to recycle stainless steel and set up bins to capture the valves.

Although the program was initiated at Kuparuk, “eventually it grew to cover all our operations, including Cook Inlet,” he said.

As the program grew, they wanted to give out recognition pins. Donajkowski said they enlisted Jim Davis to come up with a new logo every year featuring birds and animals such as swans, ducks and polar bears.

While interest in the “good guy” program waned, “all the practices remained very much engrained and in place,” he said.

Program re-energized

When Rea started coming up with ideas for environmental action in Alaska, the company adopted the name of the early employee initiative, Earth Energy Partners, and the program carried on, Donajkowski said.

Rea said the resurrected Earth Energy Partners includes external stakeholders such as the Alaska Department of Fish and Game, the Audubon Society and the Nature Conservancy.

“Now Earth Energy Partners is focused on long-term conservation of and access to key fish and wildlife habitats and populations in Alaska,” she said. “The tundra swan project is one of those projects. It seeks to get a better understanding of their migratory routes from the North Slope to their

Schuyler: environmental stewardship

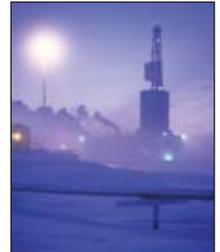
Alan Schuyler worked at Kuparuk from June 1984 through August 1996, initially as the person in the environmental compliance department, “which grew from only me to a small environmental compliance group which had four people.” Schuyler is now HSE manager at the ConocoPhillips JV in Long Beach. The department assisted in the field and ensured the oil field was in compliance with all environmental conditions of the company’s permit to operate including spill response.

Schuyler said the project or team accomplishment he’s most proud of “was the grassroots efforts of the Kuparuk community that promoted environmental stewardship of the oil field.”

He said the environmental compliance department “was instrumental in inspiring the field to promote pollution prevention processes throughout the oilfield operation,” with individual departments competing for ways “to reduce, recycle and reuse all materials required for a successful North Slope operation.” Kuparuk saved “thousands of dollars by more efficiently operating” the field as a result of these grassroots efforts.

Kuparuk was recognized for these efforts with awards from the Interstate Oil and Gas Compact Commission and the U.S. Environmental Protection Agency. “These awards recognized the efforts that demonstrate that the organization had exceeded their regular duties to protect the environment,” Schuyler said.

Kuparuk25



Stories from the field

wintering grounds in the Carolinas,” she said.

In the re-energized program ConocoPhillips is partnering with the Alaska departments of Fish and Game, Transportation and Public Facilities, the Department of Natural Resources’ Division of Parks and the Municipality of Anchorage in the Potter Marsh Trailhead and Access Improvement project initiated by Fish and Game. ConocoPhillips is providing funding and in-kind support.

The Potter Marsh work involves habitat enhancement for migratory birds and fish,

increased public access to wildlife resources, education outreach, collaborative relationships with regulatory agencies and non-profit organizations and involvement opportunities for ConocoPhillips Alaska employees. The company contributed in excess of \$600,000 for 2006 work at Potter Marsh, and has committed to spending in total some \$1.5 million for environmental projects around the state.

Phase 1 of the project, completed in the fall of 2006, includes an extension of the

see **RECYCLING** page 22



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For information on how to be included in this guide call Amy Spittler at (907) 522-9469 or email aspittler@PetroleumNews.com.

ULSD plant going in at Kuparuk in '08

Arctic ultra low sulfur diesel facility will serve both ConocoPhillips, BP North Slope operations

By **KRISTEN NELSON**
Petroleum News

By the end of 2008 Kuparuk will produce ultra low sulfur diesel at a new facility at CPF-3.

And by agreement with the Air Division at the Alaska Department of Environmental Conservation, that diesel will be used for all requirements at fields operated by ConocoPhillips and BP, by the companies and by their contractors, not just for uses mandated by law.

Some 70-80 percent of diesel uses would have been covered by the requirements. In exchange for time to design, build and install an arctic-capable ultra low sulfur diesel facility slope operators will also use ULSD in the remaining applications, said Ken Donajkowski, ConocoPhillips Alaska vice president of health, safety and environment.

Uses not required include such things as portable heaters, portable light plants and stand-by generators, he said.

The agreement saves the companies from having to truck the diesel to the



JUDY PATRICK

When you transfer liquid “you have potential for spills,” plus the additional truck traffic on the Haul Road and the potential for accidents there, he said.

Facility needed to operate in arctic conditions

Both ConocoPhillips and BP produce diesel on the slope at topping plants — one at Kuparuk and one at Prudhoe Bay.

What the companies proposed was building one plant on the North Slope to produce ULSD, but they had to get a plant designed and built that could operate in arctic conditions.

New federal rules require using ultra low sulfur diesel fuel in certain diesel-powered highway vehicles (trucks and buses) by July 2006 and in non-road engines (primarily construction and earthmoving equipment) beginning in 2010.

Under the ULSD agreement the construction of the new North Slope ultra low sulfur diesel facility is scheduled for the end of 2008, with production of the ULSD

slope. Donajkowski said one estimate found that if the companies had to haul ultra low sulfur diesel to the North Slope there would have been 20 trucks on the road at all times.

see **DIESEL** page 25

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RECYCLING

boardwalk and clearing for an expanded parking lot.

“Helping improve Potter Marsh is an excellent way for ConocoPhillips to sustain

and protect Alaska’s natural resources,” ConocoPhillips Alaska President Jim Bowles said in April. “This project is the cornerstone of our company’s Earth Energy Partners program, focused on balancing conservation and access to Alaska’s unique places.”

Kuparuk’s efforts have been recognized. The field received an Arctic Green Star Certification in 1998, an Environmental Protection Agency Region 10 Evergreen Award in 1999 and the Interstate Oil and Gas Compact Commission Environmental Stewardship Award in 2000.



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Kuparuk considered for VPP star

Field will be largest upstream facility to receive OSHA classification for occupational safety, health

By **KRISTEN NELSON**
Petroleum News

As a result of its safety program, Kuparuk is being evaluated for the OSHA Voluntary Protection Program.

The field was recommended for a "star" rating going in, rather than "merit" with an opportunity to improve to star.

The Occupational Safety & Health Administration, U.S. Department of Labor's Voluntary Protection Programs, VPP, "promote effective worksite-based safety and health," OSHA says on its Web site.

"In the VPP, management, labor and OSHA establish cooperative relationships at workplaces that have implemented a comprehensive safety and health management system," OSHA said.

VPP is OSHA's "official recognition of the outstanding efforts of employers and employees who have achieved exemplary occupational safety and health," OSHA said.

Preliminary assessment in 2005

Van Lineberger, ConocoPhillips' greater Kuparuk operations manager, said the company "had a preliminary assessment in December of 2005 in which we were visited by some consultants from OSHA to determine if we'd be a good



Kuparuk Operations Center

candidate for this certification."

ConocoPhillips "wanted to approach this field-wide. Most other operations qualify facility by facility," Lineberger said.

"Our concern with that approach was this is such a huge cultural thing for us and we didn't want to erect any barriers between our facilities. We didn't want to increase the complexity for our contractors who work from facility to facility."

After that 2005 preliminary assessment, OSHA supported the field-wide application.

The certification audit in August "went very well," he said.

"The auditors told us that they were going to recommend us for 'star' status. This demonstrates the great relationship between employees and the company and our ability to work together on these workplace safety issues."

Lineberger said they heard comments from the OSHA inspectors that included "best ever" and "best we've seen."

OSHA will forward its recommendation to the Department of Labor and the department takes that forward to the governor.

"We're hoping that within a matter of

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VPP

weeks, we'll learn that that formal recognition has been approved."

Lineberger said he understands Kuparuk would be the largest upstream facility to apply for and receive star status.

"It's a neat external assessment that demonstrates that we are on the right path," he said.

Kuparuk recommended for star

An OSHA team did a Kuparuk site visit in August.

"And we know that their recommendation is for star certification," said Paul

Dubuisson, ConocoPhillips Alaska's North Slope operations manager.

Starting with the preliminary assessment, the process took less than a year, he said.

"And typically what happens is an operation the size of Kuparuk would be split up into what would be more man-

see **VPP** page 26

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DIESEL

fuel in early 2009. In addition, ConocoPhillips and BP will spend approximately \$4 million on further emission improvements to diesel-fired sources.

ConocoPhillips and BP will use ULSD on the North Slope in all diesel-driven vehicles and equipment, including equipment not subject to the new federal rules. The producers will also require their contractors to use the cleaner fuel as well.

Donajkowski said there wasn't time to get a plant in place, so the companies agreed that in exchange for the time needed to build a plant "and not have to haul diesel, we will actually use ultra low sulfur diesel in all sources — not just what the regulation requires — but we're going to

use it everywhere we use diesel as a fuel."

"So every source, combustion source using diesel will be cleaner, not just those regulated by EPA," Donajkowski said.

ULSD will be used at Alpine; BP will use it; and the companies are going to require all their contractors to use it.

"We're ensuring that our contractors adhere to these provisions, including non-regulated sources."

There won't be significant excess capacity, but he said whatever excess diesel there is "we will make that diesel available to others."

"The complexity is such that we don't want to be building multiple ultra low sulfur diesel plants," Donajkowski said, which is why BP and ConocoPhillips will co-own the one plant at Kuparuk.

Installation in summer 2008

Paul Dubuisson, ConocoPhillips Alaska's manager of North Slope operations said modules for the ultra low sulfur diesel plant will come up on the 2008 summer sealift; installation will start that summer and the facility will be in operation at the end of 2008.

Both Kuparuk and Prudhoe Bay have topping plants that produce diesel.

"You'll take the diesel from the topping plant (at Kuparuk) and you'll put it through this new facility and it will strip the incremental amount of sulfur out of that." If more diesel is required, it will be trucked from the Prudhoe topping plant to the new facility.

The Kuparuk topping plant is at CPF-1; the new facility will be at CPF-3, where there is more space for it, Dubuisson said.

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VPP

ageable units and there might be four, or six at Kuparuk.

“And what we decided to do was to certify the entire field because we wanted to have consistency in our whole safety approach and we wanted to recognize the efforts of everyone there and not just individual areas.”

The OSHA folks were a little concerned that going for certification of the entire field may be too much, Dubuisson said. But after a three-day site visit, “they were unanimous that it was an excellent facility and it was the right way to go about it in terms of certifying the entire field.”

The number one thing, Dubuisson said, “is that everybody goes home safely.”

“But it is nice to get the external recognition of the amount of effort that folks up there put into the program.”

Kuparuk will be the largest

site within Alaska and the largest upstream unit in the United States to get the certification, he said.

Companies generally move up to star rating

When companies apply for the OSHA VPP, “they are often categorized as merit ... and over the next two, three years you work on improving your programs and your culture and then you reach star,” which is the highest rating, said Ken Donajkowski, ConocoPhillips Alaska’s vice president of health, safety and environment.

Kuparuk started out reaching for star rating, and wasn’t afraid to say so, said Donajkowski, relating an incident that occurred when the OSHA reviewers were on their way to Kuparuk for their on-site visit in August. One of them pulled a flyer out of the seat pocket in the charter plane and the flyer said something to the effect of Kuparuk

— reaching for star.

The reviewer looked at the ConocoPhillips health, safety and environment director in the seat next to him and said, “Reaching for star — most companies are glad to get merit and achieve star in a couple of years.”

“We’re that good,” the HSE director responded.

“Well, we’ll just see about that,” the OSHA reviewer said.

Donajkowski wasn’t at Kuparuk for the review — and hadn’t yet heard about the incident on the plane — when he called Paul Dubuisson at the end of the first day to see how it was going. Dubuisson said it was going pretty good, but also said the reviewers were going into great detail on the programs.

After Donajkowski heard the story about the incident on the plane he could understand why the reviewers were being so thorough.

Came the last day of the review, with about 35 people from the field at the closing meeting and up stands the reviewer who saw the flyer on the plane.

He told the group that his summary statement to the team leader was “wow.”

“He was that impressed,” Donajkowski said. It’s not typical for a company to get star going in, he said. And “here’s a guy who just feels like the gauntlet had been thrown down” and was out to see that Kuparuk was as good as it advertised.

The OSHA team leader said at the closing meeting that she was glad they had looked at the whole field, not individual facilities, because “it was apparent that the safety culture at CPF-1 was the same at CPF-2, at CPF-3, and the engagement of the contractor community was also another thing that just stood out for them.”

“They saw a consistency; and the engagement of the

contractors,” she said.

Other facilities with VPP certification

Oil and gas facilities in Alaska which have VPP star recognition are: BP Exploration (Alaska)’s Anchorage facility; BP’s gas plants at Prudhoe Bay; ConocoPhillips Alaska’s Beluga River unit on the west side of Cook Inlet; and Peak Oilfield Service Co. at Beluga.

Nationwide VPP star facilities are BP American Production Co.’s South Texas operations center in Beeville, Texas; Chevron’s Painter Reservoir unit in Evanston, Wyo.; Kinder Morgan’s Yates field in Iraan, Texas; the Whitney Canyon Carter Creek facility in Evanston, Wyo.; Koch Hydrocarbon SW LLC in Mont Belvieu, Texas; and the Texaco Maysville facility in Maysville, Okla.

BEAR: behaviors eliminate all risk

One of “the major things that OSHA highlighted in terms of ... an outstanding visible effort that they recognized is the behavior-based safety process that the employees refer to as BEAR: behaviors eliminate all risk,” Donajkowski said.

“One of the original offerings was ‘behaviors eliminate every risk,’ but they decided BEAR was probably better than BEER,” he said.

BEAR is an employee safety process. At a recent steering team meeting 62 people attended, “employees, contractors and they cover the spectrum of job functions on the slope.”

Donajkowski said his organization has some safety specialists at Kuparuk, two at each of the processing facilities. “With employees and contractors engaged in this safety observation program, we’ve got an army of resources out there focused on safety,” he said.

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THE ALLIANCE

NOTICE: This is a drill!

Kuparuk Fire Department practices rescue techniques regularly



DALE MAJESKE

Volunteers — both ConocoPhillips employees and contractors — keep Kuparuk’s emergency services running.

Van Lineberger, ConocoPhillips’ greater Kuparuk operations manager, said chiefs and assistant chiefs are dedicated, along with a technician and an aide that supports the organization, and an ACS technician.

Everybody else is a volunteer.

Dale Majeske, a Kuparuk operator, took these photographs of 2006 training exercises. A volunteer captain with the Kuparuk fire department, Majeske said the volunteers train every week on their off time from their jobs, typically two hours in the winter, but three hours in the summer when they can train at such exercises as fighting live fires.



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JUDY PATRICK

Two rigs drilling West Sak at 1J pad

By **KRISTEN NELSON**
Petroleum News

In 2004 ConocoPhillips and the other Kuparuk owners committed to expanding West Sak heavy oil production. Because of that commitment, Kuparuk River drill site 1J is the busiest in Alaska.

ConocoPhillips Alaska has two rigs drilling West Sak development wells at the new pad. At times during 2006, there were three rigs — two Doyon drilling rigs and a Nordic workover rig.

West Sak development drilling began at 1E in 2004 and will continue at 1J through 2007. The new wells are expected to increase West Sak oil production to about 40,000 barrels per day by 2008. (Production averaged about 10,000 bpd when the 1E and 1J development project was announced in 2004.)

In late 2006 there were 65 West Sak wells at Kuparuk drill sites 1B, 1C, 1D, 1E and 1J.

\$1 billion in investments

The shallow West Sak viscous accumula-

Long West Sak saga

1971	West Sak discovery
early 1980's	West Sak pilot project
1997-1998	Conventional vertical wells
1999-2000	First multilateral wells
2000-2005	Development optimization 1J pad development

tion was discovered at Kuparuk in 1971. ConocoPhillips and co-owners BP, ExxonMobil and Unocal have so far committed \$1 billion to its development.

Half of that, some \$500 million, was spent over 20 years in experimentation to bring viscous development to the commercial stage at the deepest West Sak accumulation in the Kuparuk River unit, ConocoPhillips' North Slope development manager Matt Fox said in December 2004. (At the time Fox was the Kuparuk area development manager.)

The \$500 million West Sak investment announced by ConocoPhillips and BP in 2004 at one existing Kuparuk drill site, 1E,

and one new drill site, 1J, includes 13 wells at 1E, 31 wells at 1J, expansion of 1E facilities and construction of a new pad at 1J, including facilities, pipelines and power lines.

Fox said the deeper viscous oil on the North Slope, called West Sak at Kuparuk and Schrader Bluff at Milne Point and at Orion and Polaris in Prudhoe Bay, combined with the shallower Ugnu formation, accounts for 23 billion barrels of oil in place, which is equivalent to the original oil in place at Prudhoe.

But this isn't Prudhoe. Viscous oil suffers from "a triple whammy effect," Fox said. "You've got the low rates, the low recovery factor and the low price."

Cold, heavy oil

West Sak oil isn't just heavy oil, it is "cold, heavy oil, and that means it's extremely viscous," he said.

The reservoirs are shallow, from roughly 3,000 feet below the surface to some 4,500 feet and they lie under some 1,800 feet of permafrost, so the reservoir temperatures

see **WEST SAK** page 29



JUDY PATRICK

Pad 1J under construction

continued from page 28

WEST SAK

vary from about 40 degrees Fahrenheit to about 90 degrees F," and that combination of these cold temperatures and the relatively low API means that we have extremely high viscosities," Fox said.

Prudhoe Bay and Kuparuk oil have about the same viscosity — ability to flow — as water, he said. West Sak has about the same viscosity as olive oil and the shallower Ugnu has viscosity similar to maple syrup.

In terms of production this is a big whammy, Fox said: West Sak is about 100 times as viscous as water. The flow rate of oil is "indirectly proportional to viscosity, so if viscosity increases by a factor of 100, which is what we have here going from the Kuparuk to the West Sak, rates will decrease by a factor of 100."

In addition, recovery rates are lower because West Sak oil is very difficult to move out of the pore spaces in the formation, "it's very difficult to displace because of its viscosity," he said.

And refineries pay less for lower API oil than for Prudhoe or Kuparuk oil.

Technology changes allow production

While the North Slope producers have been trying to make the shallow accumulations commercial for two decades, Fox said, the developments that finally made the best of this oil commercial have all been since the late 1990s.

Well types have changed from vertical to horizontal multilateral; drilling reach changed from moderate to extended reach; the recovery mechanism has changed from waterflood to waterflood enhanced by lean gas injection; and the method of dealing with sand has changed.

The viscous West Sak-Schrader Bluff and Ugnu reservoirs are unconsolidated, poorly cemented and sand is produced with the oil.

In the late 1990s, the focus was on keeping the sand in the reservoir by using costly sand screens in the well bores. The problem was some of the West Sak sand is as fine as flour and you couldn't devise a screen that could keep it back; plus, restricting sand with screens constrained the flow rate and was exacerbating the viscosity problem.

Fox said the solution was to focus on flow rate and deal with the sand that came to the surface by re-injecting it.

Well spacing has also changed, from 1,100 feet to 1,250 feet. It may not look like a big deal, he said, but the more distance you can put between the wells, the fewer you have to drill — a "big deal for lowering costs.

Keeping the oil flowing

Another thing that's changed is keeping the oil flowing.

Electric submersible pumps were used to move the heavy oil to the surface, but they break down, and wells had to be shut in for months waiting for a workover rig.

"And that would kill the economics of the project because of the level of the failures," Fox said.

They are still using electric submersible pumps, but now they are building in backup: the ability to use gas lift when the pumps fail, "so we can keep some level of production going, and that made a surprisingly big difference to the economic viability."

An oil-based mud system replaced a water-based mud system for drilling, improving both drillability and productivity.

And how the oil is handled at the surface changed, Fox said.

The initial plan was to mix West Sak oil with Kuparuk production since both occur at the same drill pads, but experimentation showed that wasn't enough, Fox said, so heaters are being added at the drill sites and chemicals are added to allow the sand to drop out of the oil.

And the volume of oil that can be accessed from a single well has changed because extended reach multilateral wells are now possible because of "new technologies like rotary steerable systems and more efficient torque reduction tools (and) more efficient mud systems," increasing production from some 200 bpd from 1980s vertical wells to 2,500 to 3,000 bpd from long tri-lateral wells.

Waterflood plus gas

Viscous oil is difficult to displace from

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WEST SAK

rock pores because of its viscosity, Fox said. With waterflood, a recovery rate of some 18 percent is possible. In the deeper North Slope conventional reservoirs miscible gas injection is used for enhanced oil recovery, a type of gas injection where the gas injected mixes with the oil in the reservoir.

But viscous oils "don't lend themselves to a miscible process," Fox said, so instead of miscible gas, lean gas will be used. ConocoPhillips is pilot testing this process now, he said.

The lean gas doesn't mix with the oil, but "some molecules in the gas link to the oil and very little exchange is enough to drop the viscosity dramatically," for example from 60 centipoise (a measure of viscosity) to 10 centipoise, which produces "a significant increase in the displacement."

The expected increase in recovery with lean gas injection is 20 percent over waterflood, increasing total recovery to about 22 percent.

Slope-wide sharing

"The only way we were really able to exploit these technology advantages is because we

made a concerted effort to share knowledge across the slope and within the operating companies," Fox said.

In an early 2007 comment to Petroleum News, Don Dunham, performance unit leader at BP, agreed with him, saying viscous oil production across the North Slope (BP-operated Prudhoe Bay and Milne Point plus ConocoPhillips-operated Kuparuk) has benefited from industry cooperation and technical challenge.

"BP realized that viscous oil in Alaska is so economically challenged that if the owners did not all put our heads together, we would not realize the best outcome. Alaska has benefited from this cooperation which BP hopes will continue as we look ahead to finding solutions to the Ugnu challenge," Dunham said.

"The advances in the production of the North Slope's viscous oil resources and the related technology breakthroughs would not have been possible without knowledge sharing among the West Sak co-owners," Georg Storaker, ConocoPhillips vice president of North Slope operations, told Petroleum News in January 2007. "It is unprecedented to see companies like BP, ExxonMobil, ConocoPhillips and Chevron work together to

tackle the North Slope's massive undeveloped heavy oil resources."

The North Slope viscous inter-company technical team is mainly driven by ConocoPhillips and BP with some ExxonMobil participation.

"Other co-owners supporting the team's activities are kept informed of best practices and knowledge sharing which may have broader applications," ConocoPhillips Alaska spokeswoman Dawn Patience told Petroleum News in January 2007.

One thing the viscous team has been asked to do was to improve the ability to predict rates. "We had a track record of over-promising and under-delivering and it was killing our credibility outside Alaska when we would go looking for funds," Fox said.

Sand control is another issue the viscous team tackled, as was depletion planning, getting the oil out of the ground, "and that team came up with the idea of doing viscosity-reduction gas injection," he said.

The team is continuing to work, learning from implementations and looking at what can be done next.

What about the rest?

Of the 23 billion barrels in place, some 15-16 billion barrels are at Kuparuk, with 1C and 1D, the experimental pads, developing about half a billion barrels and the 1E and 1J pads exploiting oil in place of about a billion barrels. "And that same technology that we've unlocked for 1E and 1J, we can apply to somewhere between another 800 million to a billion barrels," Fox said.

But technology breakthroughs will be required to unlock the rest of the potential.

The drilling technology can be used, "but not the recovery mechanism, not waterflood: you can't effectively waterflood." It will take new technologies, Fox said.

The exotic, heavy oil "fish bone" wells drilled in Venezuela work there because it's primary depletion only; the oil is too viscous for waterflood. They're pumping out the 10 percent they can get with primary depletion and leaving the rest in the ground, Fox said.

At West Sak, with waterflood, wells need to be in straight lines for efficient waterflood sweep.

The exotic wells might be a possibility, he said, in shallower portions of West Sak or for the Ugnu, if primary depletion were to be used there.

Steam assisted gravity drainage, used in Canada, wouldn't work for the West Sak because the sands are too thin, but it might work in the thicker Ugnu formation, and "we're running laboratory experiments and reservoir simulation experiments to try and see if we can make this viable," Fox said. "But there are some big challenges in this environment: we have 1,800 feet of permafrost (and) pumping steam through that — that has to be thought through."

The technology advances that allowed 1E and 1J to be commercial "have been rapid and they've been dramatic," Fox said. "And we're actively working on the next technology breakthrough we need to get to the even more viscous stuff."

Results to date

There was a West Sak pilot project in the mid-1980s but sustained production only began in December 1997.

Alaska Oil and Gas Conservation Commission records show 25.9 million barrels produced from West Sak through the end of November 2006, with 490,616 barrels produced in November, an average of 16,355 barrels per day from 36 producing completions.

Total Kuparuk River field production for November was some 4.4 million barrels, so West Sak accounted for 11 percent of Kuparuk production in November.

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Early 1980s: Kuparuk build continues

Following startup in 1981, CPF-2, CPF-3, seawater treatment plant, drill sites added; production reaches 298,000 bpd

By **KRISTEN NELSON**
Petroleum News

The years immediately following Kuparuk startup in 1981 saw major facilities work completed at the field, with the addition of the second and third processing facilities and the seawater treatment plant, construction of drill sites and an expanded Kuparuk sales line.

By the end of 1986, big development projects were complete, and focus had begun to shift to reservoir management.

The 1982 sealift included modules for Kuparuk including additional compression capacity for CPF-1 so the facility could handle more natural gas and maintain production levels.

The sealift also contained the first increment of the Kuparuk waterflood project for installation at CPF-1, the first large-scale water injection project on the North Slope, which began operation in early

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North Slope sealift arriving at West Dock.

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EARLY 1980s

1983, more than a year ahead of the Prudhoe Bay waterflood.

Production from Kuparuk, which had begun the previous December, was averaging more than 90,000 bpd.

Kuparuk produced more oil than expected in its first year, 31.8 million barrels, an average of 87,000 barrels per day. The field had been forecast to produce 80,000 bpd.

Ninety wells were drilled by the end of 1982, with 75 producing oil.

ARCO had 163 employees working at Kuparuk, with about half of them on the slope at any given time.

First waterflood in 1983

The first waterflood on the North Slope was initiated in January 1983 at Kuparuk, beginning with 3,200 bpd of water at drill site 1A; the rate was to be gradually increased to 5,000 bpd, and then expanded to other wells at drill sites 1A and 1E.

ARCO estimated that 1.25 billion to 1.5 billion barrels of oil would be recovered with waterflood, compared to a fraction of that volume without waterflood.

Because of arctic conditions,

Early days: Lamprecht, Masterson, Wall

- Don Lamprecht, now retired, was operations manager at Kuparuk from 1984 to 1989 and field manager from 1989 to 1991, but from 1982 he was facility engineering manager in Anchorage with responsibilities including support of Kuparuk.

“So I was fortunate to be involved with the first 10 years of Kuparuk operations,” he said in a January 2007 e-mail.

Lamprecht said Kuparuk was always a great place to work and he credited “the leadership of the first group of managers and superintendents who moved from Prudhoe to start up Kuparuk. Landon Kelly, Walt Crandall, Kenny Keys, Frank Love and John Blackwelder were those initial leaders,” he said. “They set the work ethic that still stands today. Innovation, optimism, hard work and safety were their most important values,” he said.

- The fractured nature of the Kuparuk field wasn’t initially recognized. Dallam Masterson, still with ConocoPhillips but now based in Houston, said in the 2001 20th anniversary video that “when the field first started being developed, we didn’t realize how highly faulted the field was. We had some 2-D lines across

it, but ... in the mid-1980s we started shooting some swath 3-D seismic lines, which were really 2-D lines, essentially, close to each other. And we started to see some faults we hadn’t noticed were there.”

Bob Strode, a geophysicist, scheduled a meeting with “a world-recognized seismic stratigrapher from Plano — the ARCO lab — who came up here and Bob showed him the swath data and the evidence that the field was fairly highly faulted and this world expert said well, no, I think you’re seeing stratigraphic changes in the seismic data.

“And Bob said, no, that’s not correct, these are faults.

The expert told Strode, “Young man, you have a lot to learn about seismic interpretation.”

Masterson said “of course it turned out that the field is very highly faulted. Once we shot 3-D beginning in 1988, you look at a structure map now and it looks like shattered glass dropped on the floor. So Bob was right.”

- Ray Wall started with the Kuparuk facilities project in Denver; today he’s construction superintendent at Kuparuk. He said in a

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Kuparuk25

Stories from the field

the water must be heated before injection to avoid having it freeze in the pipelines. And the pipelines must be insulated and freeze-protection systems

installed.

“The key is to keep the water moving and keep it warm,” said Landon Kelly, Kuparuk operations manager. “And we have to pump enough volume to overcome heat loss as the water travels down through the permafrost.”

Water came initially from wells; water for full-field waterflood would come from the Beaufort Sea.

By March, 22,000 bpd of water were being injected into wells on drill sites 1A and 1E, Kelly said. In Phase I the rate was gradually increased to 50,000 bpd; when full waterflood was under way in the late 1980s, an estimated 400,000 to 450,000 bpd of water would be injected.

ARCO said it expected to recover an additional 800 million to 900 million barrels of oil with waterflood.

1983: new pipeline; dock at Oliktok Point

A joint venture agreement was reached in 1983 for a 24-inch pipeline, expected to handle as much as 250,000 barrels per day by the late 1980s.

The field’s 16-inch line, which handled more than 100,000 bpd, was converted to other service once the 24-inch line was completed.

In 1983 sealift modules for Kuparuk were offloaded at a new dock at Oliktok Point, west of Prudhoe Bay, and then transported 10 miles south to the Kuparuk field; previously Kuparuk modules came into Prudhoe Bay and were transported 40 miles overland.

The 1983 sealift carried the utilities portion of CPF-2; the oil handling portion of the new facility is scheduled for the

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EARLY 1980s

1984 sealift.

Different than Prudhoe, but with ex-Prudhoe leaders

A 1983 article in the ARCO Spark, the company newsletter, gave some insight into work at the new field, now producing 100,000 bpd.

"There's an attitude up here that everybody's looking for oil," said Bob Appling, Kuparuk operations manager. "It's a personal pride that everyone shares, and everyone sees to it the job's done right."

Appling said there are a number of differences between Kuparuk and Prudhoe Bay.

"Because Prudhoe can still produce more oil than it is allowed to sell, in some cases, repairs can be made in a less than critical manner.

"Over here, we get to sell every barrel we can get our hands on. If something goes down, man, you get it fixed right then and back into production. Every minute lost is less money to the company. We take all down-time very seriously."

Appling also said that Kuparuk people are constantly looking for ways to boost production levels. "Not a week goes by that somebody isn't in here with an idea. Some we can use, some we can't. But it sure helps to have that kind of input," he said.

Appling listed a number of people as responsible for the field's first-year success, above all Landon Kelly, the field's overall operations chief. "I think everyone would agree that Landon is the single most important player at Kuparuk. He's the guy who pushed this field as a high priority long before it became one. And he's the one largely responsible for bringing it on earlier than anyone expected."

Major expansion in 1984

Installation of the second processing facility, CPF-2, was planned following its arrival on the 1984 sealift, which also carried a tripling of bed capacity for the Kuparuk Operations Center.

The sealift also included a crude oil topping plant which would be producing 3,000 bpd of diesel fuel by the end of the year.

The sealift arrived a week ahead of schedule and that contributed to getting CPF-2 online at the end of October, more than a month early, increasing production by 75,000 bpd and raising the field's total



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Installation of the second processing facility, CPF-2, was planned following its arrival on the 1984 sealift, which also carried a tripling of bed capacity for the Kuparuk Operations Center.

production to 190,000 bpd.

Kuparuk was now one of the five largest U.S. producing fields.

Harold Heinze, president of ARCO Alaska, attributed the early startup to exceptional teamwork, as well as "excellent productivity" by field construction workers and supervisors. "This is the fastest major facility ever put into service on the North Slope," Heinze said.

The new 24-inch Kuparuk pipeline went into operation Oct. 6, replacing the 16-inch pipeline in operation since field startup.

Drilling records set; more waterflood

The Alaska Spark reported in December 1984 that drilling records were being set nearly every month at Kuparuk. During development drilling in 1980, it took an average of 22 days at a cost of \$2.5 million to drill and complete a well.

The average time had dropped to 11 days and the average cost to \$1.5 million, with the current drilling record held by Parker rig 141. It drilled and cased a 6,704-foot well in four days, 23 and three-fourths hours, a drilling average of 1,348 feet per day.

Four rigs have been working at Kuparuk since the spring of 1984 and if they complete their 1984 schedule, 117 wells will have been drilled; 155 wells are planned for 1985.

Major construction by ARCO in 1985 included waterflood at Kuparuk, with construction for the seawater treatment and injection plants under way, the Alaska Spark said in May 1985.

The seawater treatment plant, two modular buildings connected by a 100-foot arctic walkway, was scheduled to go in at Oliktok Point some 20 miles from the Kuparuk main camp and will process 585,000 barrels of seawater a day through four intake bays. A jet pump will separate marine life from the arctic water and safely return them to their environment.

1985; 200-million barrel mark passed

Kuparuk set a one-day production record in October 1985 of 264,490 barrels.

"We had expected that Kuparuk production would not reach 250,000 barrels a day until late 1986, after the installation of a third central production facility," said Ben Odom, ARCO's senior vice president for operations. "However, our aggressive and innovative engineering and operations people have been able to achieve higher rates than expected from only two production facilities."

The water injection program went into operation Oct. 28, 1985, and is expected to triple recoverable oil, from 500 million barrels without waterflood to 1.5 billion barrels with waterflood.

"It's a major shift from primary production to secondary waterflooding," senior reservoir engineer Paul White told the Alaska Spark. "The recent history of Kuparuk focuses on expanding the field by drilling new wells. We'll still be expanding the field, but the focus will be coming around to managing a developed field.

"This will include developing the less productive areas of the field," White said,

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EARLY 1980s

"where the costs will be about the same but the benefits are much less."

Kuparuk passed the 200 million barrel production mark Jan. 8, 1986, two months ahead of schedule, with production at 240,000 bpd.

It had taken 32 months for the field to produce its first 100 million barrels on Aug. 16, 1984.

After CPF-2 was added in late 1984, and with continued development drilling, the 200 million-barrel mark took just 17 months.

1986 sealift last planned

The 1986 sealift was ARCO's last committed shipment of facilities to the North Slope. For the first time since the discovery of oil on the North Slope, no future major projects were in the design or construction stages, and no new facilities were planned for the 1987 sealift or beyond, ARCO said in January 1986.

The 1986 sealift included Kuparuk's third central production facility which would allow development of the northern portion of the field and help keep field production in excess of 200,000 bpd for the

next several years. Kuparuk also had modules for five new drill sites on the 1986 sealift.

ARCO Alaska advertised in Alaska for skilled instrument technicians and other oilfield operating personnel to operate the new facilities, and did receive Alaska applicants.

"The problem is that there simply are not enough experienced and technically qualified Alaskans to fill the large number of positions which are being created by the new facilities," said ARCO Alaska President Harold Heinze. "We have created so many new jobs in the past several years, in bringing on line new facilities that we have already drawn heavily from the pool of qualified Alaskan workers."

As a result, he said, ARCO is placing ads in Lower 48 papers.

The 1986 downturn

But by early March 1986, ARCO said the declining price of crude oil had forced it to reduce its North Slope development drilling activity by nearly 50 percent. Of the nine drilling rigs operating on the North Slope earlier in the winter, five were to be idled by the end of April or early May, leaving four rigs drilling new production wells for ARCO, only one at Kuparuk, with an

estimated 400 North Slope jobs affected, about 100 jobs per drill rig.

The cut in development drilling was part of ARCO's 30 percent capital spending reduction, announced in February.

The number of wells to be drilled at Kuparuk was reduced from 150 to 90.

In mid-April ARCO Alaska said the drastic drop in crude oil prices had prompted it to streamline its operations on the North Slope. The company said staff levels would be reduced and a number of employees would be reassigned to operate new facilities scheduled to arrive on the 1986 sealift.

Ben Odom, ARCO Alaska's senior vice president of operations, said the reassignment of present ARCO personnel meant no significant new hiring would take pace from outside the company. It had been estimated that 200 new employees would be needed, but a majority of those jobs, ARCO said, would now be filled by employees already working on the North Slope, whose current jobs will be eliminated by the realignment.

CPF-3 installation

Work to install Kuparuk's third central production facility, CPF-3, was to begin in June and finish in mid-October, with start-up of CPF-3 scheduled for late October.

In December 1986 ARCO Alaska said that startup of the third central processing facility at Kuparuk had boosted oil production to nearly 300,000 bpd.

Kuparuk production reached a new record high of more than 298,000 bpd on Dec. 2; production had been averaging between 250,000 and 260,000 bpd prior to startup of CPF-3. Cold weather also helped.

CPF-3 has a capacity of 80,000 bpd; CPF-1 and CPF-2 each have a capacity of 120,000 bpd.

"The addition of CPF-3 was part of the planned total development of the Kuparuk field," Odom said. "It's the last major facility for a while, following the installation of a seawater treatment plant and introduction of field-wide waterflooding last year."

Dana Dayton, manager of Kuparuk reservoir engineering, told the Alaska Spark in 1986 that "CPF-3 is the culmination of a development era. This year is unique because of a feeling of transition which many of us have.

"While we may have a big sense of satisfaction and accomplishment, we may also have some apprehension about the change from development to reservoir management," she said.

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ARCO begins in-state module building

Early West Sak pilot project concluded; major 3-D seismic shoot at Kuparuk, largest ever done by ARCO in U.S.

By **KRISTEN NELSON**
Petroleum News

1987 at Kuparuk began with announcement of conclusion of a two-year West Sak pilot project.

Operations at the pilot facilities were suspended at the end of December.

Harold Heinze, president of ARCO Alaska, said the pilot project demonstrated that conventional recovery methods can be used to produce oil from West Sak. Efforts would not focus on a plan to recover the oil economically, he said.

"In addition to solving the technical problems, it's obvious that oil prices will have to improve, with some assurance of continuing at a higher level, before our company would commit to development of the West Sak," Heinze said.

The company said ARCO employees involved in the West Sak pilot have been transferred to other operations at Kuparuk.

1987 safety goal a 20% improvement

ARCO Alaska workers at

Kuparuk exceeded their safety goals for 1986, the company said in early 1987, making them the leaders in safety performance for all producing operations for ARCO Alaska.

"These accomplishments were achieved while reaching record field production levels and during a period of aggressive cost reductions," said Jim Weeks, Kuparuk operations manager.

Employees at Kuparuk worked for 1.3 million man hours without a lost time injury, improving the safety record there by 65 percent over the previous year. A lost time injury is one which keeps a worker off the job.

Process modules to be built in Alaska

For the first time, ARCO Alaska awarded a contract for fabrication of process modules in Alaska. The contract went to VECO; the modules, for small scale enhanced oil recovery, will be fabricated in Wasilla.

"Historically, the oil industry has fabricated modules in the Pacific Northwest," said

Lee Moench, ARCO's manager of facility engineering and construction. "We're delighted to manufacture these modules within the state."

New production record in '88

Kuparuk set a new production record of 320,069 barrels a day Feb. 15. Larry Morse, Kuparuk field manager, attributed the high production to additional wells which have been drilled in the field, and to the effects of a field-wide waterflood project.

"Cold weather also helps," he said. "We get more efficiency from our gas-fired turbines when it's cold." Temperatures at Kuparuk had been as low as minus 37 degrees

Fahrenheit.

Thirty-six new development wells were drilled at Kuparuk in 1988.

ARCO Alaska President Bill Wade said in February that ARCO Alaska would invest more than \$7 billion in Alaska over the next 10 years, with more than \$3 billion going to development of known reserves. At Kuparuk that would include more wells, along with a small-scale enhanced oil recovery project with facilities under construction in Wasilla.

Wade said that over the next 10 years the project could be expanded to cover the entire Kuparuk field.

The \$7 billion also includ-

see **MODULES** page 36

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STORIES

January 2007 e-mail that the biggest change he's seen in 19 years is the "transformation and alignment from six 'oil companies' at Kuparuk (three CPFs times two shifts each) to one single company."

As for the project he's most proud of: "While the acceleration of the CPF-3 drill sites ahead of CPF-3 separation facilities was very significant (1986 drill sites were fabricated in Anacortes, Wash., and shipped

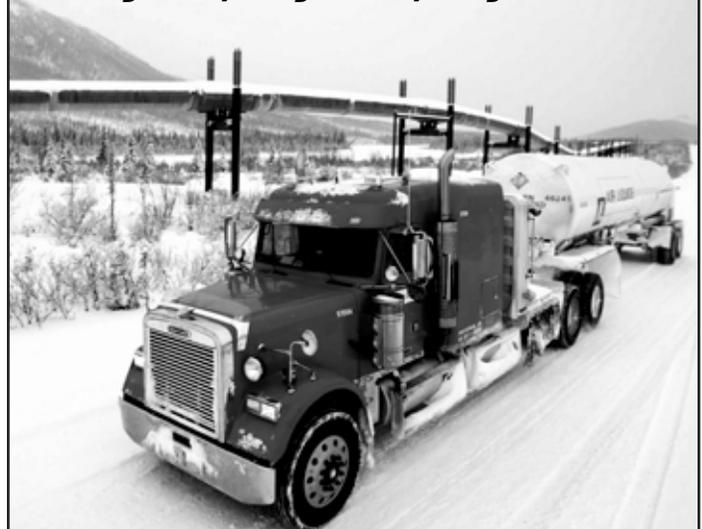
to Kuparuk in 1985 and used for early production of CPF-3 area before the 1986 CPF-3 sealift even arrived), I'm most proud of the reduction in safety incidents and injuries over time.

"Kuparuk is today a very safe place to work compared to its beginning," he said.

What's memorable about Kuparuk? "The people: there's always been a can-do spirit in the people of Kuparuk. And they've always risen to the occasion, no matter what the challenge."

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MODULES

ed “initial development of the West Sak field,” he said. Although West Sak sands are shallow and contain heavier oil, Wade said: “Given the right investment climate, we will find the way to produce West Sak.” The first phase of full field development at West Sak could cost more than \$2 billion and begin the early to mid-1990s, he said.

Major seismic shoot at Kuparuk

ARCO said March 1, 1988, that it has started work on the largest three-dimensional seismic program ever undertaken in Alaska.

The seismic was to be shot in Kuparuk.

Jerry Dees, ARCO vice president of exploration, said the 3-D exploration program is larger than any ARCO has done in the U.S.

The three year program, to



Kuparuk Operations Center

be completed in May of 1990, was over a 270-square mile area, with more than 40 million seismic readings expected to be taken during the study.

Dees said the 3-D seismic program would help in the on-going development and delineation of Kuparuk.

Reserve pit study under way

In response to new regulations from the Alaska Department of Environmental Conservation, promulgated in September 1987, ARCO Alaska submitted plans to DEC to outline two procedures it proposes to use to comply with the reserve pit portion of the regulations.

Update: ARCO environmental news, reported that the new regulations were a consensus of several years of work by state government, environmental groups and industry.

The reserve pit regulations require that new pits be open no longer than one year after use is complete and that they be maintained in a manner to prevent leakage.

One-third of the 114 Kuparuk reserve pits will be closed out over a three-year timeframe. A water management plan and monitoring program has been developed for the remaining pits, which

also will have synthetic membrane liners installed in the barrier berms.

Water in the pits will be trucked to disposal and water-flood wells.

“The water in most of our pits generally meets drinking water standards,” said Rod Hoffman, Kuparuk River unit permits director.

Ancient site found at Kuparuk

A site which served early arctic hunters was discovered in the Kuparuk oil field in the summer of 1988, Update: ARCO environmental report said in the fall of 1988.

The site could prove to be as old as 6,000 years, according to John “Jack” Lobdell, an archaeological consultant to ARCO Alaska.

Lobdell discovered a similar site in 1982 — the oldest recorded site in the coastal Arctic, dating back some 6,000 years. The 1982 site provided the first evidence that the peoples of the arctic coastal plain used the wet tundra region close to the Beaufort Sea coast. The only

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MODULES

known bone tools from that period were also uncovered by Lobdell's team.

Lobdell said the new site has not been excavated, but surface indicators suggest it was originally used as a hunting station for ancient caribou hunters who traveled on foot pursuing the migratory herds. "Two of the artifacts suggest a high proficiency of stone-working technology," he said.

The new site also appears to have been occupied by Eskimo hunters at the turn of the century. Lobdell found a blunt arrow point with a wooden shaft that was used to hunt waterfowl. He also uncovered a rifle cartridge dating before the 1900s.

The newly discovered site, like the 1982 site, is on a collapsed pingo. Pingos are the result of ice wedges in the wet tundra surface and rise above the otherwise flat surface of the coastal plain.

1989 West Sak test suspended

ARCO Alaska suspended a 25 well drilling and production test program at

the West Sak oil field in June after changes in Alaska's severance tax laws.

Bill Wade, ARCO Alaska president, said the action means delay of full-field production from West Sak, which had been scheduled to begin in the mid-1990s. Full-scale development will require a multi-billion dollar investment by industry.

Wade said changes in the economic limit factor, ELF, were aimed at increasing severance taxes at Prudhoe Bay and Kuparuk, but West Sak is also affected because it overlies Kuparuk and plans call for producing both fields through the same facilities. Changes in the ELF mean West Sak production would be penalized by higher taxes if it is combined with Kuparuk production.

"The West Sak project cannot afford higher taxes," Wade said, "nor can it afford the cost of installing a duplicate set of facilities."

Wade said ARCO would also defer some drilling at Kuparuk. ARCO had planned to add a drill rig at the Kuparuk field late this year, but those plans have been cancelled, he said.

1989 record temperatures

For six weeks in 1989, temperatures soared on the North Slope, with caribou

seeking refuge from the heat and mosquitoes in the shade of the production facilities, while oil field workers perspired in their rooms and slept on their sheets.

Oil production declined as temperatures rose—the turbines that compress natural gas for reinjection work better in the cold. Officials estimated that daily production rates fell by as much as 10 percent.

"I've been at Kuparuk for six years and this year, the hot weather has lasted a lot longer than ever before," Richard Pulley, facility supervisor at CPF-2, told the Alaska Spark, the company newsletter. "Instead of two weeks, we've had six weeks of really warm weather."

On Aug. 8, Kuparuk was the hottest place in Alaska. The temperature — 250 miles north of the Arctic Circle — was a scorching 80 degrees.

1990: 30 more Alaska modules

In July 1990, ARCO Alaska announced plans to build some 30 modules in Alaska over the next 16 months for projects at Kuparuk and in Cook Inlet, with work expected to start in October.

Jerry Pollock, engineering manager for the Kuparuk and Cook Inlet fields, said

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An Alaskan corporation celebrating 15 years of service to Kuparuk

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MODULES

the projects will include 22 modules for two new well site production facilities at Kuparuk, other modules to make environmental improvements to Kuparuk's flare system and modules to expand production at existing Kuparuk well sites.

1991: Alaska-built modules to North Slope

ARCO Alaska began transporting 11 Alaska-made drill site production modules from Anchorage to the North Slope in February 1991, and said travelers on the Parks or Dalton highways may notice extraordinarily large vehicles on the road.

The 11 modules are destined for a new drill pad in the Kuparuk field.

"This is the first time that all of the facilities for a new Kuparuk drill pad have been constructed in Alaska," the company said.

ARCO Alaska first built two Alaska-made modules in Wasilla in 1988. Since then additional Alaska-made modules have been built for both the Kuparuk and Prudhoe Bay fields.

"Alaska companies employing skilled

Alaskan workers have proven they can build these modules at a cost that is competitive with companies in the Lower 48," said Kathleen Schoen, Anchorage fabrication manager for ARCO Alaska. "This project provided work for 90 Alaskans. We're committed to Alaska hire. And we're committed to building these modules in-state."

ARCO Alaska said it planned to build an additional 50 modules in Alaska over the next two years for two new drill sites at Kuparuk as well as expansion of existing Kuparuk and Prudhoe Bay drill sites.

Kuparuk: the 10th anniversary

The Kuparuk River field marked its 10th anniversary in December 1991 with new production records.

Dec. 15 saw a single-day production record of 352,950 barrels of oil.

March 1991 saw a single-month production record of 10,068,358 barrels.

The field set new monthly production records — highest average daily rate ever produced for a given calendar month — in nine consecutive months in 1991, February through October.

Kuparuk was also expected to set a new annual average daily production rate record of up to 309,000 barrels per day

in 1991, an increase of 8,000 bpd over the old mark, set in 1988.

"The performance of the Kuparuk field has been exceptional," said ARCO Alaska President H.L. "Skip" Bilhartz. "Production is at record levels because of investment in new wells and facilities by the owner companies, and because of the efforts of the ARCO employees who engineered, built, operate and maintain the field."

"Continuing investment should allow us to keep production near present levels for the next four years," Bilhartz said.

When the field went online in December 1981, engineers expected production to peak at 250,000 bpd with ultimate recovery of 1.2 billion to 1.5 billion barrels of oil. Today, the company said, reservoir engineers expect to recover up to 1.8 billion barrels.

As of Dec. 1, 1991, Kuparuk had produced 827 million barrels of oil.

At startup in 1991 Kuparuk was producing from a 20-square mile area in which ARCO owned all the leases. The field had one major production facility, five gravel drill sites, 40 producing wells and a 26-mile, 16-inch pipeline capable of delivering 80,000 bpd to Pump Station 1.

see **MODULES** page 39

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MODULES

In 1991, the unit encompassed more than 200 square miles, had three major processing facilities, the seawater treatment plant, 40 gravel drill sites, 367 producible wells, 285 injection wells and a 24-inch pipeline capable of moving 300,000 bpd.

In early 1983 Kuparuk became the first North Slope field to use waterflooding to increase oil recovery. Waterflooding is expected to account for 1 billion barrels of the anticipated 1.8 billion barrels recovered.

In 1991 the owner companies were evaluating new methods of enhanced oil recovery and drilling additional wells on the periphery of the field.

Kuparuk wins big in stamp out waste

An article in the December 1993 issue of Kuparuk's Crude Gazette by Jennifer Huvar and Barb Byrne congratulated Dick Hunt and Dick Grief, equipment support coordinators, and Doug DeVore and Ray Quesada, fire chiefs, for winning the ARCO Alaska "Stamp Out Waste" awards for significant environmental contributions; the chiefs also won one of 10

Shakley: Costs rising, output falling

Larry Shakley was Kuparuk field manager from 1991-1994.

"When I went to Kuparuk in 1991, costs were rising and production was declining," Shakley, now doing consulting work from Branson, Mo., said in an early 2007 e-mail.

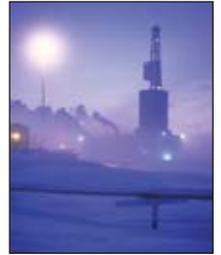
"Working closely with the Engineering Department, we developed a program to extend the economic life of the Kuparuk field called the 'Kuparuk Challenge.' Over the next few years, costs were brought under control and Kuparuk production increased," he said.

"Each department and work group made positive contributions to finding innovative ways to improve profitability and productivity at Kuparuk. The Kuparuk Challenge was a clear demonstration of what can be accomplished when everyone understands what needs to be done and works together to meet the objectives," he said.

And what was memorable about Kuparuk?

"The people—they were some of the most innovative individuals I have had the pleasure of working with in my career at ARCO. They did not shrink from a difficult situation, but worked together to find solutions to problems that some people did not think were possible. They had a great sense of humor and always enjoyed showing the Anchorage executives they could do the impossible."

Kuparuk25



Stories from the field

\$2,000 awards at the corporate level.

DeVore and Quesada, with the help of local staff and summer interns, converted the fire training props from diesel-burning to natural gas-burning apparatus. Natural gas, as a by-product of the field, has no cost and is much safer to use

because the person operating the valves during training can completely shut the gas off to extinguish the fire immediately.

Hunt and Grief saved the company \$39,280 by replacing one-time use oil filters in Kuparuk's fleet of pickups and heavy equipment.

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Mid-'90s see focus on cost cutting

Large-scale enhanced oil recovery approved for Kuparuk; alignment agreement will make satellite developments easier

By **KRISTEN NELSON**
Petroleum News

The margins at Kuparuk are thin, an article in The Crude Gazette, the Kuparuk newsletter, explained in 1994.

"Anything and everything can impact our margins, including: OPEC, the state Legislature, production, operating costs and capital spending," said Dan Lawrence.

At a West Texas Intermediate price of \$16 a barrel, the budget estimate for 1994, the margin on Kuparuk crude is 36 cents a barrel, he said. Unfortunately, oil prices had been \$1 to \$2 a barrel below budget so far in the year, so, he told Kuparuk readers, "you can see it's not a favorable situation in which we find ourselves."

The price of crude oil impacted the entire company: a staff reduction of 750 was announced in June 1994.

ARCO Alaska President Ken Thompson said while the reductions were painful for all employees, they were "necessary to enable ARCO to be a long-term competitor in the global market."

The company had 2,800 employees in 1990; that number was down to 2,350 in 1994; and the goal was 1,600.

Thompson said reductions would affect every area of the company, both Anchorage and the North Slope.



Exploration drilling at Kuparuk

He said ARCO Alaska would continue to explore for new economic sources of oil in areas close to existing fields and available transportation and would seek new ways to flatten decline of production from existing fields, and even stem that decline.

Recycling at Kuparuk

One person's garbage — scrap wood — is another person's fuel, said a 1994 article in The Crude Gazette.

Lisa Pekich reported that Kuparuk had started a scrap wood recycling project, collecting it in conexes and hauling it back for donation to the Palmer Correction Facility where it was used as fuel in wood-burning boilers.

Pekich said the idea came from a summer intern working for the Drilling Department.

Benefits to Kuparuk?

In the first month of implementation,

see **COST CUTTING** page 41

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COST CUTTING

dumpster pickups from the warehouse were cut in half — from once in two weeks to once a month. As of October, she said, 10 full conexes had been shipped to Palmer, saving some \$15,000 in disposal costs.

Also in 1994, Nancy Remmler, writing for the Kuparuk Athletic Club committee, said KAC is offering the Kuparuk Winter Challenge, a triathlon, with participants rowing 2,500 meters, biking for 8 kilometers and finishing with a 2 mile run on the treadmill, or the biathlon, with participants biking for 4 kilometers followed by a 1 mile walk.

Participants will be racing against the clock for a personal best, Remmler said.

Drilling resumes

Drilling has resumed at Kuparuk, James Thantham and Mike Zanghi reported in the April 1995 issue of The Crude Gazette.

Parker 245 immediately broke field records, they said.

After being stacked for five months, the rig drilled more 12-1/4 inch hole in a single 24-hour period than ever before,

4,627 feet, the top 10 12-1/4 inch footage records for the field.

The second well drilled, 1R-33, set field records for measured depth and departure, they said. The well had a total depth of 15,530 feet and the departure from the surface location is 12,775 feet, with a total vertical depth of 6,946 feet, a measured depth to total vertical depth ratio of 2.2.

They said the bottom hole of the well is three miles from 1R pad, and between two wells from 3H pad.

The third well drilled, 1R-34, holds the field's second longest MD at 13,570 feet with a departure of 10,467 feet.

Zanghi also reported that the Kuparuk drill site development group established in 1994 to provide economic evaluation, design and construction of wells and facilities for Kuparuk development projects combines functions of petroleum engineering, facilities, materials and drilling.

He said the group intends to work closely with Kuparuk production to meet Kuparuk field objectives.

1995: LSEOR approved by state; 1996 startup

The Alaska Spark reported in October

1995 that the State of Alaska has approved the large scale enhanced oil recovery project at Kuparuk.

LSEOR is expected to extend the life of the Kuparuk field and increase its oil recovery by more than 200 million barrels.

The project will use approximately 100 million barrels of Prudhoe Bay natural gas liquids, which will be transported to Kuparuk through the Oliktok pipeline and reinjected at Kuparuk.

Approximately 35 percent of the NGLs will eventually be produced as part of the Kuparuk crude stream. Changes in state tax regulations as they apply to NGLs made the project more attractive to ARCO and the other co-owner companies.

Some \$135 million will be spent on 66 injection and production wells on the field and the companies will also invest \$38 million in two new facility modules.

LSEOR started as a small-scale pilot project in 1989 on two Kuparuk drill sites and favorable results inspired planning for expansion.

The project received funding approvals in March 1995.

ARCO Alaska began testing miscible

see COST CUTTING page 42



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Kuparuk EOR 'my proud baby'

*Tuan Ma, now a reservoir engineer with ConocoPhillips Asia Pacific organization, was at Kuparuk from 1985 to 2002.

"Kuparuk EOR was my proud baby during those years. I was privileged to justify the Kuparuk small scale EOR project and coordinate the implementation of the large scale EOR expansion project," Ma said in a 2007 e-mail.

Kuparuk25



Stories from the field

"It was fun participating in the company ad about Kuparuk's 'souped up natural gas' with Janet Weiss and Scott Kerr," Ma said. "And who is not impressed with the caliber of people and assets that we have on the North Slope."

*Jim Short was involved with Kuparuk permitting and environmental issues during the 1980s and in

2006 returned to ConocoPhillips at Alpine.

"One big change is the large increase in volume and complexity of regulations, along with associated procedures, monitoring and reporting," he said in an e-mail. "Two of the largest increases have come in air quality control permitting and spill response readiness.

"The Kuparuk work force has always done an exceptional job at managing HSE responsibilities and meeting new regulatory challenges," Short said.

The project or team accomplishments Short is most proud of are sealift and startup of CPF-3 and the Kuparuk seawater treatment plant and "reduction in the footprint size and elimination of reserve pits for new drill sites."

As for field history, Short said many people now do not know that "the 'J' and 'K' shifts at Kuparuk were named after the first camp managers, 'Joe' Morgan and 'Kirk' Barker."

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COST CUTTING

gas EOR on two of Kuparuk's 42 drill sites in 1989, and field owners approved LSEOR and expansion of the process to 20 drill sites in the southern half of the field.

Tuan Ma, Kuparuk development EOR coordinator, said in the Alaska Spark in February 1997 that Kuparuk's large scale enhanced oil recovery, LSEOR, "charged out of the gate on schedule Sept. 1."

The Kuparuk EOR process mixes the field's own lean gas with indigenous natural gas liquids and imported Prudhoe Bay NGLs to make a "souped-up gas," miscible injectant or MI, which is injected alternately with water, acting as a solvent and displacing most of the oil left behind by water injection toward producing wells.

LSEOR is expected to add another 200 million barrels to Kuparuk reserves.

The MI rate quadrupled from some 50 million cubic feet per day to 216 million cubic feet per day in the fourth quarter of 1996. The LSEOR helps blow down the CPF-1 gas storage area by using more lean gas to make MI, Ma said.

The project is expected to produce an oil wedge of 12,000 barrels per day in 1997, a wedge which will grow to some 40,000 bpd by the turn of the century.

1997: drilling cost reduction

In 1997 the Kuparuk drill site development team plans to reach its long-term goal of reducing drilling development costs by 30 percent, the Alaska Spark said in late 1996.

Since this quest started in 1994, the organization has taken a second look at how wells are drilled, applied some existing technologies and developed some of their own technology along the way.

Kuparuk wells have been redesigned to optimize performance, maintain production rates and meet the team's low-cost, long-term goals.

"The objective was cost reduction through redesign of the wells and eliminating those things that are not absolutely necessary to develop the reserves," said Mike Zanghi, Kuparuk drill site development supervisor.

The size of the wells was reduced and in some cases one string of pipe was eliminated and they made completions simpler.

The cost of drilling a well was reduced from an average of \$1.6 million in 1993 to an expected \$1.1 million in 1997.

"We've gotten the side-track cost down to where for close to the same cost as a workover we can get a new well bore and direct the well to a spot in the reservoir where we really want it," Zanghi said.

The drilling schedule will also change in 1997, with the first half of the year spent on Kuparuk wells and the rest of the year spent on phase 1 of West Sak and the Tabasco reservoirs.

By the end of 1996,

see **COST CUTTING** page 44

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Kuparuk Timeline 1969-2006

1969

Sinclair Oil and Sohio (BP) discover oil at the Kuparuk River oil field on Alaska's North Slope.



1974

Construction begins on the 800-mile trans-Alaska oil pipeline from the North Slope to Valdez in April 1974.



Pipe being laid at Tonsina River.

1977

Construction of the trans-Alaska oil pipeline was completed in May 1977.



Final pipeline weld near Pump Station 3, May 31, 1977..

1979

ARCO Alaska commits to the development of the Kuparuk River oil field. Sealift work for main camp modules and the Kuparuk Central Processing Facility 1 gets under way.

1981

On Dec. 13, 1981, the first Kuparuk oil hits the trans-Alaska oil pipeline at Pump Station 1. Two days later, on Dec. 15, Kuparuk owners and the State of Alaska sign an operating agreement for the field.

State and Kuparuk officials sign operating agreement



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COST CUTTING

Kuparuk will try its first multilateral well using a new approach; three multilaterals have been attempted at Prudhoe Bay, and the Kuparuk team worked closely with Shared Services Drilling to learn from that work.

The Kuparuk team is also focusing on potential development of an ultra slim-hole for injector wells.

Satellite development accelerated

As many as 50 satellite oil fields have been mapped on the North Slope, with combined accumulations of more than 1.2 billion barrels — excluding West Sak, the Alaska Spark said in December 1996.

Kuparuk is anticipating a facility sharing agreement before the end of 1996 to allow development of reserves that wouldn't otherwise be developed because the fields are too small to justify their own facilities.

In 1996 six owner companies (ARCO, Chevron, Phillips, Mobil, BP and Exxon) from the Prudhoe Bay unit joined forces to study a group of satellites: Schrader Bluff, S Pad Kuparuk, West End/NEW Kuparuk, Sierra Nevada, Sambuca and Beechey State.

Kuparuk went a step further. In November 1996 ARCO and BP moved to common equity on all their interests in the Kuparuk area and announced an agreement to establish common equity in 63 leases bordering the Kuparuk unit. The final agreement will include additional acreage within the Greater Kuparuk Area.

"Kuparuk has the advantage that 95 percent of the field is owned by two companies," said Kuparuk Development Manager Scott Kerr. "So we took the position that if we align our interest across the field; cross-assign all of our acreage; agree in advance to facility access terms and some ability to go non-consent; then we won't have any more arguments over equity or agreements. We'll set everything up in advance and that's what we're doing."

A number of satellites have been identified within the Kuparuk area and the equalized equity agreement means that either company can move forward to explore and develop the satellites. Though the majority of the area is owned by the two companies, other companies have a smaller interest in the field and have been invited to partici-



pate in the facility sharing agreement.

The Kuparuk agreement is in its final stages and includes: cross-assigned acreage; a new operating agreement and special provisions for dealing with West Sak and other heavy oil reservoirs.

Three prospects are scheduled for exploration drilling in the winter of 1996-97 and additional 3-D seismic is planned for the western area of Kuparuk and the adjacent acreage.

"We've often said that about half of the known oil resource in Kuparuk is yet to be developed," Kerr said. "An estimated 5 billion barrels of oil is in place and has yet to be exploited. That includes West Sak, but it also includes other resources that we believe to be there."

The risk factor of bringing satellite fields online exists when the maximum capacity for handling gas and water at each facility is reached. While the facilities have room to handle more oil, several have reached the maximum capacity for handling gas, some have also reached capacity for handling produced water.

Tarn: Satellite development begins

1997 begins with announcement of discovery west of Kuparuk; testing yields in excess of 2,000 bpd

By **KRISTEN NELSON**
Petroleum News

ARCO Alaska said March 10, 1997, that oil had been found in two delineation wells and a sidetrack in the Tarn prospect west of Kuparuk.

Testing of the Tarn 2 yielded a steady, stimulated flow rate in excess of 2,000 bpd of 38 degree API gravity oil from a sandstone reservoir discovered at a depth of 5,200 feet. Tarn 2 is the first well drilled in this year's three-well Tarn exploration program.

ARCO and BP also announced the signing of an alignment agreement that will quicken the pace of oil exploration in and around Kuparuk. The agreement provides for joint exploration and appraisal of a 580-square-mile area that includes the ARCO-operated Kuparuk River unit and adjacent acreage. The agreement also allows production of satellite oil accumulations through existing Kuparuk facilities and clears the way for West Sak development.

"This agreement will allow us to unlock the full potential of the Greater Kuparuk Area," said Ken Thompson, president of ARCO Alaska. "It encourages exploration, facilitates development and maximizes use of existing facilities. When we have exploration success it will allow us to move new production quickly to market."

"The agreement establishes a new, more cooperative way of doing business on the North Slope," said Richard Campbell, president of BP Exploration (Alaska). "It will accelerate resource development, provide opportunities for Alaskans and enhance state revenues."

ARCO said joint exploration drilling during 1997 may include two prospects in addition to Tarn — Cache and Tabasco. Cache will test three prospective horizons below the Kuparuk reservoir. A well drilled and tested in 1995 indicated the shallow Tabasco prospect could be commercial. A planned 1997 well will test a separate Tabasco accumu-

lation identified with 3-D seismic survey data.

The 1997 joint exploration program also includes a major 3-D seismic survey designed to better delineate known prospects and to identify new ones.

ARCO said that to date the Greater Kuparuk Area joint exploration team has identified more than 10 satellite prospects—including the West Sak heavy oil accumulation—which together could yield potential reserves of almost 1 billion barrels.

The agreement aligns all ARCO and BP ownership of tracts within the Greater Kuparuk Area at 58.5 percent for ARCO and 41.5 percent for BP; ownership of existing Kuparuk production is not changed by the agreement.

Tarn development announced

On April 30, 1997, ARCO and BP announced plans to develop the previously announced Tarn oil discovery; Tarn is adjacent to the southwest corner of the Kuparuk River unit.

Pending issuance of local, state and federal permits, field construction and development will begin in early 1998 with initial production of 10,000 to 15,000 bpd in late 1998 or early 1999.

Evaluation of a 3-D seismic survey and data from a three-well, one-sidetrack delineation drilling program completed earlier in April indicates that the northern area of Tarn contains estimated proven and potential reserves of 50 million barrels.

Field development is estimated to cost about \$120 million.

ARCO Alaska, as operator, has started engineering for a one or two drill site development that could include up to 50 wells, along with a nine-mile pipeline to move Tarn production to existing processing facilities in the Kuparuk field.

Construction of drill sites, pipeline and necessary power lines will begin in early 1998 with development drilling

1983

First West Sak/Ugnu pilot evaluation is done in 1983. Construction of Kuparuk's Central Processing Facility 2 and the Seawater Treatment Plant is under way, and CPF-1 waterflood starts up. At the end of the year the Seawater Treatment Plant begins operating.



Seawater Treatment Plant
Courtesy Conoco Phillips

1984

The second processing facility at Kuparuk (CPF-2) begins operating in 1984.



CPF-2 at Kuparuk. Courtesy ConocoPhillips

1985

The Kuparuk Topping Plant is built to produce diesel fuel for use at Kuparuk and elsewhere on the North Slope.

Crude oil topping plant.



1986

Divert tanks are installed in 1986. And there's a sealift for the construction of the third processing facility at Kuparuk — Central Processing Facility 3.



JUDY PATRICK

1987

The third processing facility at Kuparuk, CPF-3, begins operating.



CONOCOPHILLIPS

1988

Small scale enhanced oil recovery (SSEOR) begins and 1Y/2Z Infill. The Kuparuk field reaches oil rate of 300,000 barrels of oil per day for the first time. The STP clarifier starts up, and a 3D seismic shoot begins in 1988, ending in 1991.



CONOCOPHILLIPS

1990

Kuparuk equity is finalized in 1990.

1993

Kuparuk reaches its peak daily production rate of 339,000 barrels. Kuparuk receives the ARCO President's Safety Award for CPF-2, and the Kuparuk spill response center is completed.



Kuparuk Earth Energy Partners Program Initiated

1994

In 1994 the Alpine field to the west of Kuparuk is discovered and delineated by ConocoPhillips and its partners. In September, Process Safety Management (PSM) is implemented.



CONOCOPHILLIPS

continued from page 45

SATELLITES

during the summer of 1998.

Kuparuk wins ARCO Environmental Achievement Award

Kuparuk's aggressive pollution prevention program was recognized in 1997 with the ARCO Environmental Achievement Award. The program is also low cost, saving thousands of dollars each year, said Kuparuk environmental coordinators Barb VanderWende and Lisa Pekich in the Alaska Spark in August 1997.

Pollution prevention is the focus of the Kuparuk waste management strategy, they said. "If no waste is generated, nothing needs to be collected, transported or managed."

The key to the program's success is inclusion in core business processes, with management support and departments including pollution prevention in their work processes.

The nearest landfill is some 50 miles away and charges \$1,300 per 27-cubic-yard dumpster.

And hazardous waste has to be transported more than 2,000 miles for handling.

Waste reduction at Kuparuk ranges from reconditioning and reuse of laser printer toner cartridges to reduced pad site to reclaiming and reuse of brine in drilling.

West Sak, Tarn production begins

1997 and 1998 saw production start at both West Sak and Tarn

The West Sak oil field began commercial production from the field's first producing well Dec. 26, 1997.

Production from the well, 200 bpd, is being slowly increased and is expected to reach the project's production target of 300 bpd.

Fifty West Sak wells, both production and injection wells, are scheduled for completion by early 1999. Work on the field began in October 1997. Nine wells have been drilled and cased and will soon be in operation.

"This effort will develop 51 million barrels of new reserves and add near-term production of 4,000 b/d gross in 1998, increasing to 7,000 b/d day gross in early 1999," said ARCO Alaska President Ken Thompson.

ARCO Alaska and BP said Aug. 24,

1998, that commercial production has started from the Tarn oil field nine miles southwest of Kuparuk.

Tarn is producing 18,000 barrels of 38-degree API gravity oil per day from five wells and will reach production rates of approximately 25,000 bpd from 20 wells, 12 producers and eight injectors, by year-end 1998.

The field is expected to reach peak production of more than 30,000 bpd by late 1999, ranking it in the top 30 producing domestic oil fields.

Tarn is a 50 million barrel oil accumulation and the second satellite accumulation to begin production in the Kuparuk River unit since December 1997. ARCO, BP and the other co-owners previously announced the startup of the West Sak oil field.

"For the industry and the state these new satellite fields will mean new reserves, new production and new state revenue," said Kevin Meyers, president of ARCO Alaska. "For ARCO, Tarn is one more step toward achieving our Alaska production goal of 'No Decline After '99.'"

"Satellite developments like Tarn play an important role in BP's plans to grow our Alaskan production over the next few years and sustain it at more than half-a-million barrels a day into the future," said Richard Campbell, president of BP Exploration (Alaska). "They're also an important new source of jobs and business opportunities for Alaskans."

Full development of the Tarn oil field will include 40 wells from two drill sites. The field was first deemed a commercial discovery in March 1997. Field development is estimated to cost about \$150 million.

"These new oil fields have been brought quickly on production because the Kuparuk Alignment Agreement allows production from satellite accumulations like West Sak and Tarn to be processed through existing Kuparuk facilities," said Kuparuk Senior Vice President Frank Brown.

1998: Tabasco production to be increased

ARCO Alaska, BP Exploration (Alaska), Unocal, Chevron USA, and Mobil Exploration and Producing said Aug. 27, 1998, that they have applied for state permission to begin commercial production from the Tabasco oil field, a shallow, viscous oil accumulation that overlies

see **SATELLITES** page 47

Thoughts from Alzheimer, Jepsen, Werner

• Dave Alzheimer, who has been an engineer at Kuparuk since 1985, noted two big changes: “The first is a substantial increase in the total number of people who work there. The second has been a steady growth in the application of better technologies to operate a declining field as effectively as possible.”

Alzheimer said he is most proud of the progress in automation.

“In 1985,” he said, “the board operators used pneumatic controllers to control each facility. Today we have a large installation of distributed and programmable logic based control systems to help operate the facilities and drill sites. This transition required a motivated work force willing to accept change and to contribute many good ideas to optimize operation of the facilities.”

• Scott Jepsen, ConocoPhillips Cook Inlet manager, worked at Kuparuk from 1982-1990 and from 1997-2000.

Jepsen said the Kuparuk alignment agreements “allowed the unit to start development of the satellites,” including the development of Tarn in 16 months. “It was on budget as well.”

• “What I find probably the most rewarding thing that I’ve ... had in my career here was my long-term involvement with West Sak, and certainly the project itself and the people I’ve been involved with — the progress that’s been made with that project,” said Mike Werner, greater Kuparuk geoscience, in the 2001 20th anniversary video.

“It’s very rewarding after working with it on and off for about 17 years to actually see startup in 1997 of commercial production from West Sak.”

The biggest change he’s seen is in how wells are drilled, how data is collected and handled. Werner said he thinks West Sak demonstrates the impact of technology changes, especially in horizontal well technologies. “It’s totally different from the ... work processes we had when I first started (and) it continues to change.”

Kuparuk25



Stories from the field

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SATELLITES

the Kuparuk reservoir on Alaska’s North Slope.

Test production from a single Tabasco well began May 13 and the well is producing more than 2,500 bpd of 16.5 degree API gravity oil. Following approval of commercial production by the state, plans call for drilling up to 20 production and injection wells over the next few years with production increasing to more than 10,000 bpd in 1999.

The new field has estimated reserves of as much as 30 million barrels of oil.

“This field could be larger,” said ARCO Alaska President Kevin Meyers. “A 3-D seismic survey indicates the Tabasco formation extends beyond the area we are now developing. We are planning a delineation drilling program to determine the full extent of the reservoir.”

Tabasco was discovered in 1986 during development of the underlying

Kuparuk field. Tabasco is the second viscous oil development in the Kuparuk area, following startup of the West Sak oil field in December 1997. It is the third Kuparuk satellite oil field to begin production in the last year. Like the Tarn field which began production in late July, Tabasco will be produced using existing Kuparuk infrastructure.

“Development of these viscous oil reservoirs is possible because of new, low-cost drilling and completion technologies and because we’re able to make extensive use of existing Kuparuk drill sites and processing facilities,” Meyers said.

BP Exploration President Richard Campbell said, “Tabasco is one of a number of satellite accumulations in and around existing fields which will help to grow and sustain North Slope production into the foreseeable future.”

1999: cost restraint; BP buys ARCO

ARCO Chairman and CEO Mike

see **SATELLITES** page 48

1995

Kuparuk gets its own athletic club.



1996

Large scale enhanced oil recovery (LSEOR) start-up at Kuparuk, and the first ARCO/BP Alaska Safety Handbook (ASH) is published.



Kuparuk drill site

1997

In 1997 Kuparuk receives ARCO’s Environmental Achievement Award for pollution prevention, the first North Slope Environmental Field Handbook is published, and the BEAR employee safety process is initiated. In March the ARCO/BP Alignment Agreement for Joint Exploration and Appraisal is signed. West Sak begins producing in December.

1998

In 1998, Kuparuk receives ARCO Corp.’s Environmental Achievement Award (FLIR system). Kuparuk satellites Tarn and Tabasco begin producing, and Kuparuk receives its Arctic Green Star Certification.



1999

In 1999, Kuparuk won the EPA Region 10 Evergreen Award. By April, the Kuparuk unit had produced 1.6 billion barrels of oil, which was the initial expected recoverable for unit. By August, Kuparuk reaches 1 million man hours worked without a lost time injury.



2000

In 2000, the Kuparuk unit receives the IOGCC Environmental Stewardship Award, and in May, the Meltwater discovery is announced. Meltwater is the fourth Kuparuk satellite.

2001

The Kuparuk unit receives the Phillips Corp. Shield Award for Environmental Achievement in February, followed the next month by the Alaska Governor's Safety Excellence Award for CPF-2. In March the unit had produced 1.75 billion barrels of oil to date; by April it had handled 2 trillion cubic feet of formation gas. The first Palm exploration well was drilled late that year.



JUDY PATRICK



Kuparuk flowlines

JUDY PATRICK

2002

In 2002, the AOGCC expanded the area of the Kuparuk River Oil Pool; and DNR expanded areas of the Kuparuk River Unit and the Kuparuk Participating Area. Those decisions allowed for more development.

2003

Kuparuk satellite Palm's three development wells are producing as much as 16,000 barrels of oil per day.

West Sak pipeline construction



CONOCO PHILLIPS

2004

ConocoPhillips announces plans for the largest-ever heavy oil development at West Sak

2005

The \$500 million-dollar expansion of West Sak viscous oil project 1J gets under way. By July the Kuparuk unit has produced 2 billion barrels of oil.

2006

Kuparuk Operations is nominated by OSHA in 2006 for its VPP Star certification for the entire field, which will make Kuparuk ConocoPhillips' largest upstream entity to receive such an award.

Meltwater discovered, in production

Palm does better than expected; new 3-D seismic planned for Kuparuk, coiled tubing in-fill wells

By **KRISTEN NELSON**
Petroleum News

Phillips Petroleum bought ARCO's Alaska assets in March 2000 and named Kevin Meyers president and CEO of Phillips Alaska, which included all of ARCO's Alaska businesses, plus all of Phillips' Alaska operations, including the Kenai LNG plant.

The new company soon had something to celebrate, announcing the discovery of Meltwater on May 2, 2000.

Meltwater was estimated to contain about 50 million barrels of proven and potential reserves.

Meltwater North 1, about 10 miles south of the Tarn oil field in the Greater Kuparuk Area, tested at 4,000 barrels per day of 37-degree API gravity oil. A second exploration well and sidetrack, Meltwater North 2 and 2A, confirmed a northern portion of the reservoir.

The discovery was made on acreage purchased in June 1998 in the first areawide lease sale ever conducted by the State of Alaska. Phillips holds a 58.46 percent interest; BP holds a 41.54 per-

cent interest.

Meltwater has the potential to be the fourth Kuparuk satellite field to begin production. The West Sak field began production in 1997, and Tarn and Tabasco began production in 1998.

"State areawide leasing and the application of advanced 3-D seismic technology made this discovery possible in less than one year," said Michael Richter, Phillips Alaska vice president of exploration and land. "This discovery marks a new era in the Alaska oil industry. This is Phillips Alaska's first discovery as a new company and the first discovery this century for the State of Alaska."

"This discovery signals a bright start to exploration in the new millennium and will also serve to move production infrastructure further south than ever before. Our goal is to bring this new field on production as quickly as possible. We will soon be working with Phillips on a field development plan," said EX. O'Keefe, exploration business unit leader for BP Exploration (Alaska).

see **MELT WATER** page 49

continued from page 47

SATELLITES

Bowlin told the Alaska Support Industry Alliance's annual conference in January 1999 that the company remains committed to key projects on Alaska's North Slope despite the downturn in oil prices and a reduction in the company's capital budget.

"Only the most competitive projects in ARCO's global portfolio survived the cut for 1999," Bowlin said. These projects include Alpine, the Prudhoe Bay miscible injectant expansion or MIX project, and the Point McIntyre enhanced oil recovery project.

Bowlin said ARCO Alaska was not hit as hard by cost reductions as other ARCO units because it was already a low-cost leader. He commended ARCO

Alaska, its co-owners, contractors and the state government for efforts that have significantly reduced ARCO's per-barrel operating and overhead costs since 1994.

ARCO had announced a \$500 million two-year cost reduction plan in October 1998, the first major oil company to do so, Bowlin said. ARCO said it would eliminate 1,200 jobs, mostly administrative and technical in Los Angeles and Plano, Texas, close some 20 small offices around the world and downsize others.

Bowlin said there would be \$330 million in upstream reductions over two years, with exploration spending reduced by \$150 million, mostly international, and production costs and overhead to be cut by about \$110 million.

On April 1, 1999, BP announced plans to acquire ARCO.



COURTESY CONOCOPHILLIPS ALASKA

Meltwater drilling

continued from page 48

MELT WATER

Production began from Meltwater in late 2001

Initial production began from Meltwater at 3,000 barrels per day Nov. 29, 2001. Meltwater was discovered in March 2000 and road, pad, power line and pipeline construction were done over the 2000-2001 winter season. The 50 million barrel field is in the southwestern portion of the Kuparuk River unit, some 27 miles from central processing facility 2.

Ryan Stramp, Phillips Alaska's Meltwater development coordinator, said Meltwater is the most distant of the Kuparuk satellites — only 10 miles from Tarn, but some 25 miles from production facilities at Kuparuk.

The company's process engineers had to determine if crude oil from the Meltwater pad "would make it on its own energy, or were we going to have to put some pumps or some sort of processing" at the pad.

They decided that with a large diameter pipe at the Meltwater pad the natural

energy from the reservoir would move the crude oil approximately 25 miles to the processing facility.

Stramp said 17 or 18 wells would be drilled initially, results assessed, and then the final eight or 10 wells drilled. The reservoir at Meltwater is a little shallower than Kuparuk, about 5,200 feet, and conventional directionally drilled wells are planned.

"We've got one central pad and we're going to develop several square miles of reservoir by directionally drilling out in all directions around the pad," Stramp said.

The 2000 exploration well produced at 4,000 bpd during a short-term test.

Palm exceeds expectations

Meanwhile, there was another name change for the company: Phillips Petroleum combined with Conoco in August 2002, creating ConocoPhillips and, in Alaska, ConocoPhillips Alaska.

The Palm discovery, developed as Kuparuk drill site 3S, had production of 29,000 bpd in July 2003, exceeding pre-development expectations of a peak of 16,000 bpd by 2004. There are 17 wells at

the drill site, nine producers and eight MWAG injectors.

The project came in under budget and ahead of schedule.

Development drilling

began in November 2002 and the field came online Nov. 14, 2002, initially producing 2,350 bpd of 26-degree API gravity oil from a single well.

see **MELT WATER** page 50



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Drilling at Palm

continued from page 49

MELTWATER

The accumulation is estimated to contain 35 million barrels.

Time from spud of discovery well to first production was 20 months.

New 3-D at Kuparuk

ConocoPhillips and BP announced expansion of West Sak on Aug. 10, 2004 (see West Sak story in this publication).

Work continued on the main Kuparuk reservoir.

Matt Fox, then the company's greater Kuparuk area

development manager, said in December 2004 that a new 3-D seismic survey would be shot across the Kuparuk field.

Kuparuk, he said, "is one of the most complex fields in the world from a geological perspective, from a faulting perspective — it's just incredibly complex. You combine that with the fact that we're doing a miscible gas injection enhanced oil recovery. You can't go many places in the world and find anything more challenging than this."

Because Kuparuk is so complex, there are still opportunities there, Fox said.

The 3-D seismic shot in the winter of 2004-05 uses "new technology that's designed to allow us to image in the reservoir where the oil and gas are" allowing the company to target sidetracks, he said.

More coiled tubing work

ConocoPhillips is also experimenting with coiled tubing drilling techniques.

Coiled tubing drilling has

been used successfully at Prudhoe Bay, Fox said, "but the geology at Kuparuk makes coiled tubing drilling more of a challenge. ..."

In addition to 3-D and coiled tubing, ConocoPhillips is "building a new full-field reservoir simulation model at Kuparuk," which, Fox said, is challenging "because of the complexity of the field." He said the combination of new 3-D seismic, coiled tubing drilling and the new reservoir simulation model "are going to allow us to get the most from Kuparuk, whether it's through base management or through new development.

"We can't stop Kuparuk declining," he said, "but we can slow the decline down" and fill in with West Sak developments.

The combination of the new 3-D seismic and the reservoir simulation model and well performance will let ConocoPhillips identify areas where it doesn't seem to be

see **MELTWATER** page 51



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MADE IN ALASKA

Dobson, O'Dell, Hannon comment on changes

• Engineer Stephanie Dobson, who now works in Anchorage with ConocoPhillips, worked at Kuparuk in 1992 and from 1998-2004.

“The biggest change that I’ve seen over the years about Kuparuk is the attitude people both internally and externally associate with the field. Kuparuk was always the ‘little brother’ to Prudhoe Bay.

“Kuparuk is more vulnerable to lower oil prices than Prudhoe,” she said.

The technological breakthroughs that got the field to 2 billion barrels of oil, “and that’s despite oil prices — this has really gotten people excited about it again,” demonstrated by the level of investment at the field over the last five years.

“It’s like the reservoir that could.”

Dobson also said that in the early 1990s she wouldn’t necessarily have predicted the enhanced oil recovery and coiled tubing drilling work that have contributed to the field’s success.

• Brian O’Dell, now wells coordination supervisor for ConocoPhillips’ North Slope operations, has worked in the Kuparuk group since 1982, with three years off for a Cook Inlet assignment in the early ‘90s.

“Some of the biggest and most significant changes I’ve seen since I first started working here involve the evolution of Kuparuk from a pseudo-satellite field of Prudhoe Bay (the ‘other’ field on the North Slope) to a hub for the surrounding satellites of Kuparuk (Alpine etc.) Kuparuk has grown to become a production and operations center for the Western North Slope development.”

Kuparuk25



Stories from the field

“There are really too many team accomplishments over the years to single one out. Things such as producing over 130,000 bpd through a facility originally designed for 80,000, all of the facility expansions and installations, and the new wells drilled and added to the field are all significant achievements.

“These types of efforts, along with engineering developments and innovations, like WAG flooding and MI EOR, and many of the innovative and creative drilling and well intervention developments, like coiled tubing drilling, multilateral wells and improved artificial lift systems, are all accomplishments that have helped keep Kuparuk a great place to work for the 25 years we’ve been here on the slope.”

• Engineer Renee Hannon started working Kuparuk from the Plano ARCO lab in 1982, she said in the 2001 20th anniversary video. “We were working with the reservoir engineers up here on formation damage studies, trying to determine the best stimulation treatment of Kuparuk.

“Kuparuk was just an infant back then and it does turn out that fracturing is probably one of the best stimulations.

“Ten years ago, in 1992, I was working Kuparuk here in Anchorage and I was the lead of the geoscience group and Kuparuk back then was this energetic, bubbling teenager, producing over 300,000 barrels of oil per day. ... We were still peripheral drilling and in-fill drilling back then.

“And more recently, I’m working Kuparuk now, another decade later, 2001, and Kuparuk right now is very different. It’s like this laid-back, mature adult, getting ready for retirement. However, it’s given birth to four or five satellites ... (with) very nice character (that) help production rates.”

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MELTWATER

getting all the oil it could “if there were no geological problems.” The seismic will identify opportunities, he said, such as an oil trap “up against the fault, and then we can tale a coiled-tubing side-

track up against that fault so that we pull the oil in.”

Coiled tubing wells will also increase rates because they are drilled as horizontal sidetracks.

Fox said that while coiled tubing can’t achieve the lateral lengths a rotary rig can, “we don’t need those lengths

because it’s quite a tight well spacing in Kuparuk anyway. What we need is the accura-

cy, the ability to see it and then get after it with the coiled tubing.”



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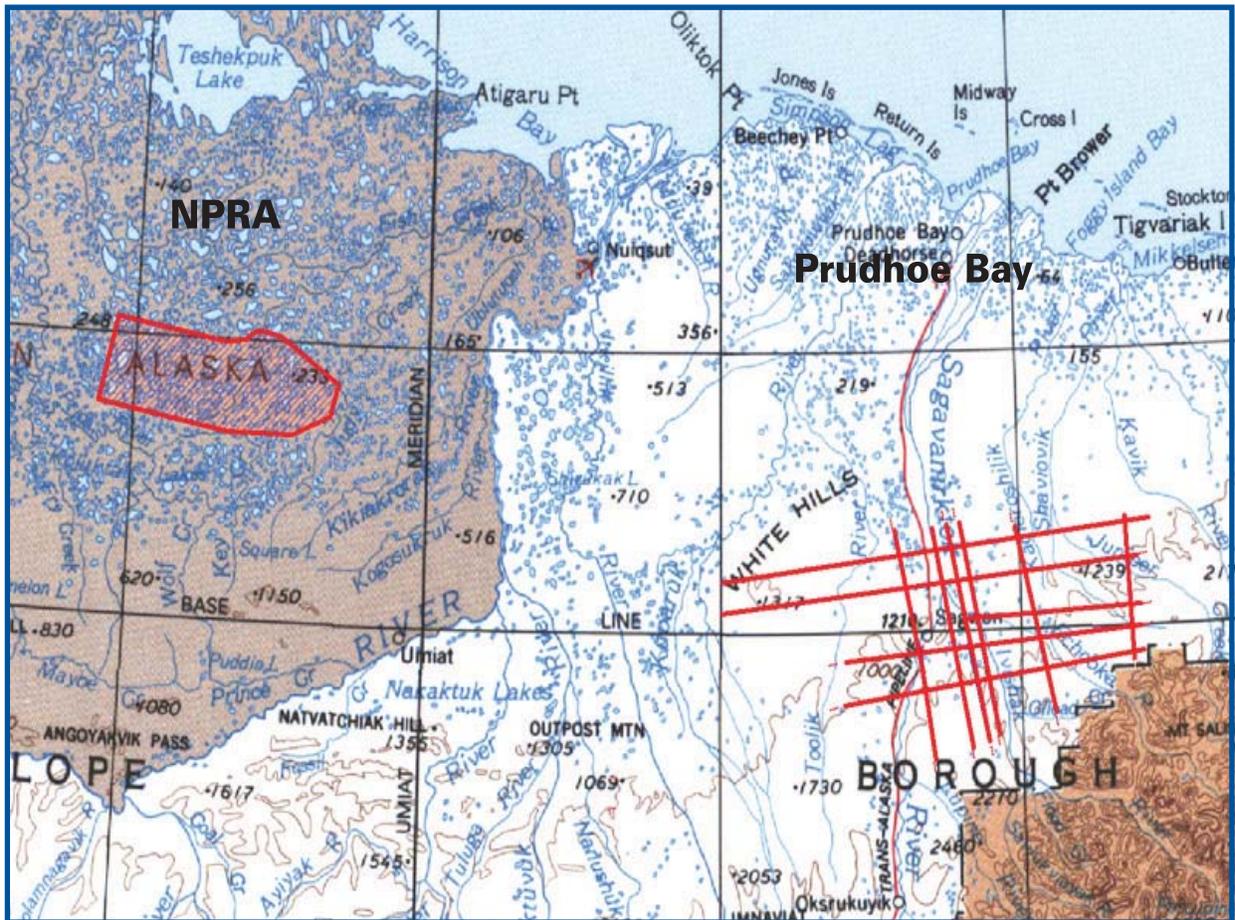
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Kuparuk discovery made by Sinclair at Ugnu No. 1

The Kuparuk oil field was discovered in 1969 when Sinclair Oil and Gas and BP drilled the Ugnu No. 1 and tested 1,056 barrels per day of oil from the Kuparuk formation.

Sinclair was an acquisition target of Gulf and Western. O.P. "Pen" Thomas, then Sinclair's president, said it would not have been a good deal for the company's shareholders.

"We moved quickly and cut a deal with Atlantic Richfield to stave off Gulf and Western," Thomas told the ARCO Spark, the company newsletter, in a 1982 interview.

Before Sinclair became a part of ARCO in 1969, it spud the Kuparuk discovery well on the North Slope.

Sinclair's Colville No. 1, drilled in 1965-66, had been a dry hole.

At Ugnu No. 1, however, the company discovered Kuparuk.

Christopher Lewis related in a 2006 talk that Sinclair's desire for a successful well on the North Slope was tied to the possibility of acquisition by Gulf and Western. "The thinking was that if we would spud a well, our stock would go up and Gulf and Western wouldn't get us," he said.

Well named for nearby river

As to why the well was named "Ugnu," Lewis said the Ugnuravik River ran through the area. "It was really a small stream. Ugnuravik was too long," he said, so they called the well Ugnu.

That name is carried today by the shallowest and most viscous of North Slope oil formations.

The fame of the Ugnu No. 1, however, is not the formation of that name, but as the discovery well for the Kuparuk River field.

Lewis said the discovery was a surprise and led to a reevaluation of the area's geology.

"We were drilling at 6,000 feet without any hope of getting anything because we were down dip" from the earlier well, a dry hole, he said. "I was having my dinner when the crew said we had had a break," an increase in the rate of penetration as the drill bit encountered porous layers of rock.

"When I looked at the cuttings, I realized that we had an excellent oil sand," Lewis said.

"Our surprise was complete when the test produced oil," he said. "We recovered oil at a rate of about 1,000 barrels per day at that well."

—Kristen Nelson



Development announcement in 1979

Although Kuparuk was discovered in 1969, shortly after Prudhoe Bay, it wasn't until early 1979 that Atlantic Richfield announced it was proceeding with field development. The initial drilling and development program, for the first processing facility, associated drill sites and pipeline, was tagged at about \$350 million. Average daily production of some 60,000 barrels per day was expected by 1982 and, with additional investment, and production of 100,000 bpd by 1984.

ARCO said this was the first phase of what could eventually become a \$1 billion investment among several companies holding leases in the Kuparuk field; the initial effort, however, was exclusively by ARCO on ARCO leases.

ARCO Chairman Robert O. Anderson said the company was moving ahead because it felt Alaska's negative investment climate, created chiefly through adverse tax policies, showed some sign of improvement. Anderson also said that further development beyond the initial phase would depend on the economics of the project and the future investment climate in Alaska.

The initial drilling and development program, for the first processing facility, associated drill sites and pipeline, was tagged at about \$350 million.

Earlier in the year ARCO and Sohio had filed a suit against the State of Alaska, challenging the constitutionality of an Alaska corporate income tax that affected only the oil industry. "The lawsuit contends that the state's present tax structure discourages high-risk investments for exploration in Alaska's frontier areas," he said. "The Kuparuk represents a fairly well-known quantity, with limited risk, which differs from the high-risk investments cited in the lawsuit."

Approval a challenge

Just getting to development approval was a challenge.

Landon Kelly, on the team that studied Kuparuk development in 1976, told the ARCO Spark, the company newsletter, in early 1981 that even in 1978 they were unable to convince management to develop the field, considered "marginally economical."

The team tried again in 1979. By then rising oil prices and the national need for domestic energy made Kuparuk attractive.

"It's very exciting, though the expanded scope is making everything hectic," Kelly said.

The scope had expanded because ARCO decided to get the field started up by the April 1982 target date and at the same time expand the project and develop the whole field.

The first phase, exclusively ARCO, targeted 20 sections, 20 square miles. At the same time, ARCO put together a long-range plan for Kuparuk and was working with owners of adjacent acreage to agree on a development plan.

The long-range plan amounted to a tenfold expansion and covered some 200 square miles.

—Kristen Nelson



Getting there and other challenges

1979-81: initial Kuparuk development, including KOC, CPF-1, first drill sites, temporary and permanent bridges

By **KRISTEN NELSON**
Petroleum News

Getting there is half the fun — or challenge — could have been the motto for initial construction at Kuparuk.

First there were the sealifts and the struggle to get facilities modules to the North Slope in the short window each summer when there was an opening in the ice.

And once modules reached the North Slope, they had to be moved from West Dock at Prudhoe Bay, across the Kuparuk River, to the new field.

Initial Kuparuk facilities came in on three sealifts: The 1979 sealift brought in the warehouse, shop, vehicle storage and hanger. Workers were still installing those in the spring of 1980, along with doing piling work for modules and laying more gravel in advance of the 1980 sealift, which would bring in the permanent base camp, sewage and power facilities. Final facilities for initial production only arrived in the summer of 1981.

The ARCO Spark, the company newsletter, said workers finished installing Kuparuk's 245-bed construction camp in the winter of 1979-80. Six development wells were drilled along with two exploratory wells to confirm more high-potential Kuparuk areas.

Project growing even as initial construction under way

In 1980 ARCO was also putting together an expanded long-range Kuparuk development, a multibillion-dollar plan to include several working interest owners in the expanded 200-section development. Three additional facilities (central processing facilities 2 and 3, and the seawater treatment plant) would be installed to meet Kuparuk pipeline capacity of 200,000 bpd.

"We have drafted a unit agreement and a joint operating agreement for the development which we're sending to co-owners so we can unitize the field," North Slope district Kuparuk engineer Jerry Pawelek told the ARCO Spark. "We hope to begin negotiations on this by late 1980 and we hope to have the field unitized by early



Morrison-Knudsen Co. and NANA Development Corp. did construction for ARCO Alaska Inc. Here a drill rig bores hole for pipe supports on Kuparuk River crossing.

1981."

ARCO would be field operator and peak capacity of 200,000 bpd was planned for 1986 — a big change from an original projection of 60,000 bpd.

Jim Weeks, head of the Kuparuk project group, told the ARCO Spark that expansion altered the facilities thinking — the permanent camp was upgraded and the capacity for both more drill sites and more processing facilities was added.

Pawelek worked unitization, reservoir engineering and facility design, while Landon Kelly, the Kuparuk operations manager, ran the camp and oversaw facility design and installation.

Just getting there a challenge

One of the challenges of developing Kuparuk was getting there from Prudhoe, Prudhoe being the connection to the Dalton Highway, known as the Haul Road, and initially the necessary connection to West Dock for module delivery, although Kuparuk later had its own dock facilities at Oliktok Point.

At spring breakup in 1980, culverts at ARCO's \$5 million Kuparuk River crossing washed out, temporarily closing the Kuparuk Spine Road — a road needed to

move sealift modules to the field.

A temporary river crossing had to be in place by August to move 1,000-ton equipment-bearing modules. If the river crossing wasn't ready ARCO planned to move the equipment overland in the winter.

Weeks, who headed the Denver-based Kuparuk project group which designed, constructed and installed Kuparuk facilities, told the ARCO Spark that three of the 12 culvert sections gave way June 9 and over the next four days the rest of the culvert sections collapsed into the Kuparuk River.

In a 2001 interview with Petroleum News, Weeks talked about the bridge problem — and about the challenges of getting Kuparuk developed.

"From the start, Kuparuk had ... the reputation of being the down-to-earth, low-cost, sort of get-it-done-cost-effectively oil field," said Weeks, the first project manager for Kuparuk. "That was our mandate from the company."

"We developed a lot of new technology at Kuparuk, and we broke the paradigm that you couldn't start something up in the same year you shipped it," Weeks said.



COURTESY STEVE HUBBARD

Derrick for Doyon rig 9 on side; Kuparuk Operations Center under construction in background.

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GETTING THERE

Kuparuk River a challenge

The bridge over the Kuparuk River was a stumbling block.

The sealift was due in August 1980 and materials for Kuparuk, including the power plant, would have to go across the Kuparuk River. A bridge was needed. Weeks said plans were under way the previous fall, but permits didn't come through until after freeze-up — and the gravel that would be used for fill already had ice crystals in it.

When the Kuparuk River floods at breakup, it becomes three miles wide. "We couldn't justify building a three-mile bridge, so what we did is build a bridge on the main channel" with two low-water crossings on either side. Even the central bridge would be expensive, so they chose the type of "massive, corrugated culverts used for train tunnels." The culverts were backfilled with compacted gravel.

"The actual strength that held the load up on the top of the bridge was not the culvert but the gravel," Weeks said. The gravel was key — it pushed against the sides of the culverts, giving them the strength they needed.

"But when we built the bridge the backfill was frozen. You can pound on ice

all day long and it's not going to compact," Weeks said.

At breakup, the gravel started to thaw out, the ice crystals melted "and the gravel lost its ability to push against the side shells of the pear-shaped culverts, and they collapsed."

Weeks and Kelly purchased all the surplus 48-inch Alyeska Pipeline Service Co. pipe they could find in the state and used it to install a temporary bridge to meet the August sealift.

Permanent bridge needed

After getting the temporary bridge in place to meet the sealift, a permanent bridge was required before the field could be started.

Because of the strength of the Kuparuk River breakup, pilings for a permanent bridge were massive: 42 inches in diameter, so big they could not be made in the United States, they had to come from Japan, lashed to the deck of a ship because of their diameter and 80-foot length.

At Kuparuk, 54-inch holes, 100 feet deep, were drilled for the pilings, but the ship encountered a storm in the Gulf of Alaska and some of the pilings went overboard.

Without the pilings in place water

The early challenges

- Scott Kerr, now managing director of Norwegian Energy Co. in Stavanger, Norway, worked Kuparuk for ARCO three times in his career.

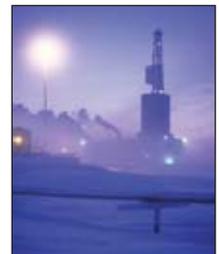
He was there in 1979-80, before field startup, logging the early Kuparuk 1D pad wells and said in an e-mail that there were many challenges at

Kuparuk, including "the disposal of gas, which we were working in 1979-80 even before the field started producing."

But the immediate problem in 1979 was keeping the trucks running.

Kerr said his first memory of Kuparuk is just before Christmas in 1979. "I was logging one of the D pad wells, D-4, I think, and the Engineering group had purchased some pick-up trucks in Anchorage to use on the slope.

Kuparuk25



Stories from the field

see **CHALLENGES** page H4

see **GETTING THERE** page H4



continued from page H3

CHALLENGES

“Operations did not have enough vehicles so we had to buy our own,” he said.

“Unfortunately the trucks were not winterized for use on the slope and if they were left to idle they would slowly freeze so we had to leave the logging truck every hour or so and drive the trucks up and down the road to warm the engines up.

“It was bitter cold out.

“What I remember was how still and absolutely beautiful it was out. The northern lights were out and the only lights around were from the rig and rig camp. I was totally alone but it was absolutely incredible.”

- Tom Wellman was at Kuparuk at construction — when Jim Weeks was struggling with the Kuparuk River

see **CHALLENGES** page H5

continued from page H3

GETTING THERE

would fill the holes at breakup and thaw them out and the holes would collapse.

The Japanese could get them more piling, but not until September or October, and the holes needed to be saved: they held a contest.

John Larson, an ARCO engineer, suggested using some of the surplus 48-inch pipe ARCO had bought for the temporary bridge, cutting the pipe into 15-foot lengths and putting a cap on each section.

Weeks said they hung a section of pipe into each hole, insulated the area between the 48-inch pipe and the 54-inch hole and backfilled. “We essentially put a plug in the top of the hole and froze it back in place,” Weeks said. Forty holes were saved. The replacement pilings came in and were put in during the fall of 1981, allowing startup to take place at the field.

Tired vehicles used for faster module delivery

Ground speed was another problem: crawlers used at Prudhoe Bay only traveled a half-mile per hour and it was 40 miles from West Dock at Prudhoe to Kuparuk, so the Kuparuk team used rubber-tired vehicles with trailers that moved at five mph.

“We got the modules set on the piling in October of ’81,” Weeks said, and things were going so well that he thought with overtime they could bring Kuparuk up that year. ARCO authorized “a couple million” for overtime and incentives, and with a construction force of 500 including 120 ARCO employees working around the clock the field started up three months ahead of schedule, on Dec. 13, 1981.

It was the first time that a major North Slope facility had been started up in the same year as the sealift.

There were other innovations: at Prudhoe each turbine got its own module. “We couldn’t afford that luxury” at Kuparuk, Weeks said, and multiple turbines were put in a single module.



continued from page H4

CHALLENGES

bridge and he talked about that in the company's 2001 anniversary video.

One day when they were drilling holes for the pilings for the permanent bridge he got a call from the construction manager, informing him that a caribou had fallen in one of the piling holes.

"Right away, of course, I'm suspicious," he said, knowing the area would have been blocked off for the work.

"No, no," the construction manager insisted, "he's kind of wedged down in there, we think at about 50 feet." They had tried dropping a rope down, but were afraid they'd kill the caribou trying to pull him out.

The guy was so serious, Wellman related, that he was starting to wonder how in the world he was going to explain the caribou to the regulators.

"And then he tipped me off," Wellman said. "He said, 'you know, we didn't have any engineers on site and we're not wor-

ried about lowering an engineer and losing the engineer — we're afraid he'd fall on the caribou and hurt the caribou!"

About then, Wellman said, he could hear Jim Weeks start to laugh in the background.

"It was all a setup just to get me riled."

• Jack Walker was at Prudhoe in 1981. He said in a 2001 interview for the Kuparuk 20th anniversary video that he decided to drive over and see what was going on at Kuparuk.

"And of course the road restrictions weren't what they are today and I guess the water was a little deeper than I expected trying to cross the river and I thought I was going to get swept down to the Beaufort Sea for a little bit, but we made it over there and looked around Kuparuk. And this would have been the summer before startup. . . . It was quite an experience."

• Jeff Kewin "first got involved in Kuparuk in 1981, which was right about the time of unitization and when field development was just blowing and going,"

he said in an interview for the 2001 20th anniversary video.

"My first trip up to Kuparuk, the road ended at 1A pad. And CPF-1 was kind of a combination between a bucket of bolts and the real thing. And there was just all kinds of activity going on — people running everywhere, projects groups, operations groups kind of coming in and taking over . . . the plumbing that had been fitted together to date.

"And the drillers were, of course, running wild and it was quite a heyday."

Kewin said "it was a real privilege to be involved in Kuparuk from, almost from day one.

"And when we first started over at Kuparuk . . . we realized, if we'd come from Prudhoe, we'd made our first foray into the Arctic and it had been a great success.

"But when we came to Kuparuk we knew we were going to have to work under a different paradigm.

"And from day one Kuparuk was set up, the whole spirit of Kuparuk was to have fun at what you did."



COURTESY WASHINGTON GROUP

Morrison-Knudsen Co. and NANA Development Corp. did construction for ARCO Alaska Inc. This is a view of the storage area and pipe fabrication shop.

Production begins 3 months early

Kuparuk comes online in December '81 from 5 gravel drill sites in 20-mile square ARCO-owned area

By **KRISTEN NELSON**
Petroleum News

Production began at the Kuparuk River oil field on Dec. 13, 1981, three months ahead of schedule.

When the board gave the go-ahead in 1979 to spend \$450 million for initial field development, it was expected that

production would begin April 1, 1982. Paul Norgaard, president of ARCO Alaska, said ARCO was able to speed up completion by giving the project priority status.

Initial production was expected to average 80,000 barrels per day from 40 wells on five gravel drill sites.

ARCO owned all the state oil and gas leases in the 20-square mile area included

in the initial development and said agreement was expected soon among leaseholders in the entire Kuparuk field to operate the field as a unit, with ARCO as operator.

Ultimate recovery, with successful waterflood, was expected to range

see **PRODUCTION** page H7

Early wells were Kuparuk formation, in spite of names

First the discovery well was the "Ugnu No 1" — Ugnu being the shortened name of a nearby river — though it is the discovery well for the Kuparuk reservoir, not the shallower Ugnu.

Compounding the confusion, Kuparuk delineation wells were called "West Sak," although they were

ARCO Alaska officials told the Alaska Oil and Gas Conservation Commission in 1981 that between 1969 and 1980, ARCO and other companies drilled 25 wildcat and extension wells in an attempt to

define the limits of the Kuparuk accumulation.

Jim Posey, who worked on the startup team, talked about that delineation drilling in the 2001 20th anniversary Kuparuk video.

"We wanted to know how far the field extended before we filed the papers with the state, so we had them drill the perimeters of the field, starting with West Sak No. 13, 14 ... and going up to West Sak 20," said Posey, who worked on unitization for the startup team.

Posey said it was a multiple effort: they were trying to find the edge of the field, "at the same time do unitization and get this thing online by 1981, which was the target."

The names have changed.

Production wells at the field have names beginning with Kuparuk River Unit, followed by the satellite name — Tarn, Tabasco, Meltwater or West Sak, if appropriate — and then by a pad and well number.

—*Kristen Nelson*

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PRODUCTION

between 1.2 billion and 1.5 billion barrels of oil.

But by the end of November 2006, Kuparuk and its satellites (Tabasco, Tarn, West Sak and Meltwater) had produced 2.19 billion barrels of oil according to Alaska Oil and Gas Conservation Commission records.

ConocoPhillips said Kuparuk reached the 2-million-barrel milestone in April 2004; the company said more than 2.6 billion barrels of an estimated 6 billion barrels of original oil in place are expected to be recovered.

Expansion, waterflood

ARCO said at startup that plans called for two additional central production facilities over the next four years, boosting production to 250,000 bpd. That production level was based on waterflood. Expansion plans called for the second CPF to go into operation in 1984, boosting production to about 200,000 bpd. A third facility, scheduled to start up in 1986, would boost the total to 250,000 bpd. By the time the field was fully developed it was expected to cost the owners \$10 billion.

Natural gas produced at Kuparuk along with the crude oil would be re-injected into the reservoir until gas sales occur "sometime in the future," ARCO said in 1981. At 80,000 bpd, ARCO expected the field would produce 35 million cubic feet of natural gas per day. A portion would be used for fuel at the field and about 25 million cubic feet a day re-injected.

A 16-inch pipeline was constructed to carry Kuparuk oil to Pump Station 1 of the trans-Alaska pipeline.

Facilities included a 96-bed operations center delivered on the 1980 summer sealift and opened late that year with dining and kitchen facilities, a theatre, card and game rooms and an exercise room.

CPF-1, the first of three central processing facilities, was delivered on the 1981 sealift.

Kuparuk oil is heavier than Prudhoe, 23 degrees API vs. 27 degrees API for Prudhoe. Kuparuk oil is 1.6 percent sulfur, the company said, compared to 0.5 percent sulfur for Prudhoe crude.

Kuparuk waterflood, begun in



COURTESY CONOCOPHILLIPS ALASKA

The central production facility is the heart of Kuparuk. Two-hundred foot communications tower soars over the Kuparuk oil field's central production facility which will process up to 80,000 barrels a day of crude oil for delivery to the trans-Alaska pipeline at Prudhoe Bay. The Kuparuk field, 40 miles west of Prudhoe Bay, went into operation in December 1981.

1983, came on before waterflood at Prudhoe in 1984.

The net sand thickness averages about 50 feet in the Kuparuk reservoir compared to nearly 600 feet at Prudhoe, and average initial well rates for Kuparuk are expected to be 1,500 bpd, compared to 10,000 bpd at Prudhoe.

Peak higher than projected

In 1981, ARCO expected Kuparuk production to peak in 1986 at 250,000 bpd. Production actually peaked at 322,000 bpd in 1992.

Kuparuk has been the second largest U.S. oil field. In 2005, however, it dropped to third, behind the Wasson field in Texas, in ranking by the U.S. Department of Energy's Energy Information Administration based on liquids proved reserves from estimated 2005 field level data. Prudhoe ranked first.

Based on volume produced in 2005, Prudhoe would still be first, Mississippi Canyon Block 807 (Mars-Ursa) in the Gulf of Mexico would be second, Wasson third and Kuparuk fourth.

Newer technology at Kuparuk

The Kuparuk River oil field was developed later than Prudhoe Bay and benefited from newer technology.

Most obvious is the reach of drilling rigs — which dramatically reduced the size of drill sites.

In 1970, a Prudhoe Bay drill site was 65 acres and from that 65 acres drill rigs could access a subsurface area two miles across.

A 1980 Kuparuk drill site was 24 acres and rigs could access an area three miles across.

By 1985, Kuparuk drill sites had dropped to 11 acres, but the subsurface reach was five miles across.

By 1999 at Alpine, a drill pad of 13 acres could access a subsurface area eight miles across.

The reservoir was also different: Kuparuk is at about 6,300 feet, compared to 8,000 to 9,000 feet at Prudhoe Bay.

And the net thickness, the "pay" at Kuparuk, is about 50 feet compared to nearly 600 feet at Prudhoe.

The sizes of the reservoirs are about the same: some 200 square miles.

Based on remaining recoverable reserves, ARCO estimated in 1981 that Kuparuk was probably the second largest field in the United States, behind Prudhoe.

Original owners still represented

Ownership of the Kuparuk River unit has remained the same over the years — only some of the names have changed.

Field operator ARCO Alaska reported eight other companies involved in 1981 unitization discussions: BP Alaska Exploration, Sohio Alaska Petroleum and Union Oil Company of California were the other major owners; smaller interests were held by Exxon, Mobil, Phillips Petroleum, Chevron U.S.A. and Amoco Production.

All, through purchase or merger, are still involved:

Phillips bought ARCO Alaska, then merged with Conoco and today operates the field as ConocoPhillips Alaska.

Both Sohio and Amoco are now part of BP.

Chevron has purchased Unocal. Exxon and Mobil have merged.

