SB 168

<TARGET><BILL>SB 168</BILL><SUBJECT>SB 168</SUBJECT><COMM>SFIN28</COMM></TARGET>

Possible Questions

Can we increase the production of oil from the legacy fields?

How will commercialization of gas affect oil production?

We know there is 13% CO_2 in ANS gas. (This will be separated from the gas in the Gas Treatment Plant on the slope.) Does it have value for use on the North Slope to increase oil production?

Can we get more oil and blow down the fields at the same time?

When should we start developing heavy oil?

What should the State know about heavy oil development?
Field optimization?

Students:
What does a graduate petroleum engineer expect to make working for a major oil company?

What parts of the world would you like to work in during your career as a petroleum engineer?

Would you recommend studying petroleum engineering in Alaska?

Alaska North Slope (ANS) Coventional and Unconventional Oil and Gas

(Resource Characterization and Development)

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Professor of Petroleum Engineering

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Undergraduate Research Assistants

Petroleum Development Laboratory

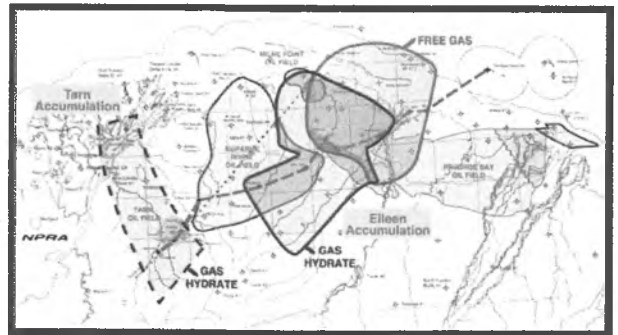
UAF™ UNIVERSITY OF ALASKA FAIRBANKS

PDL

PDL Mission: Resource Development

Mission: **Resource Development**

- conventional oil
- viscous/heavy oil
- natural gas
- hydrate/associated free gas
- GTL Transportation, and
- CBM resources



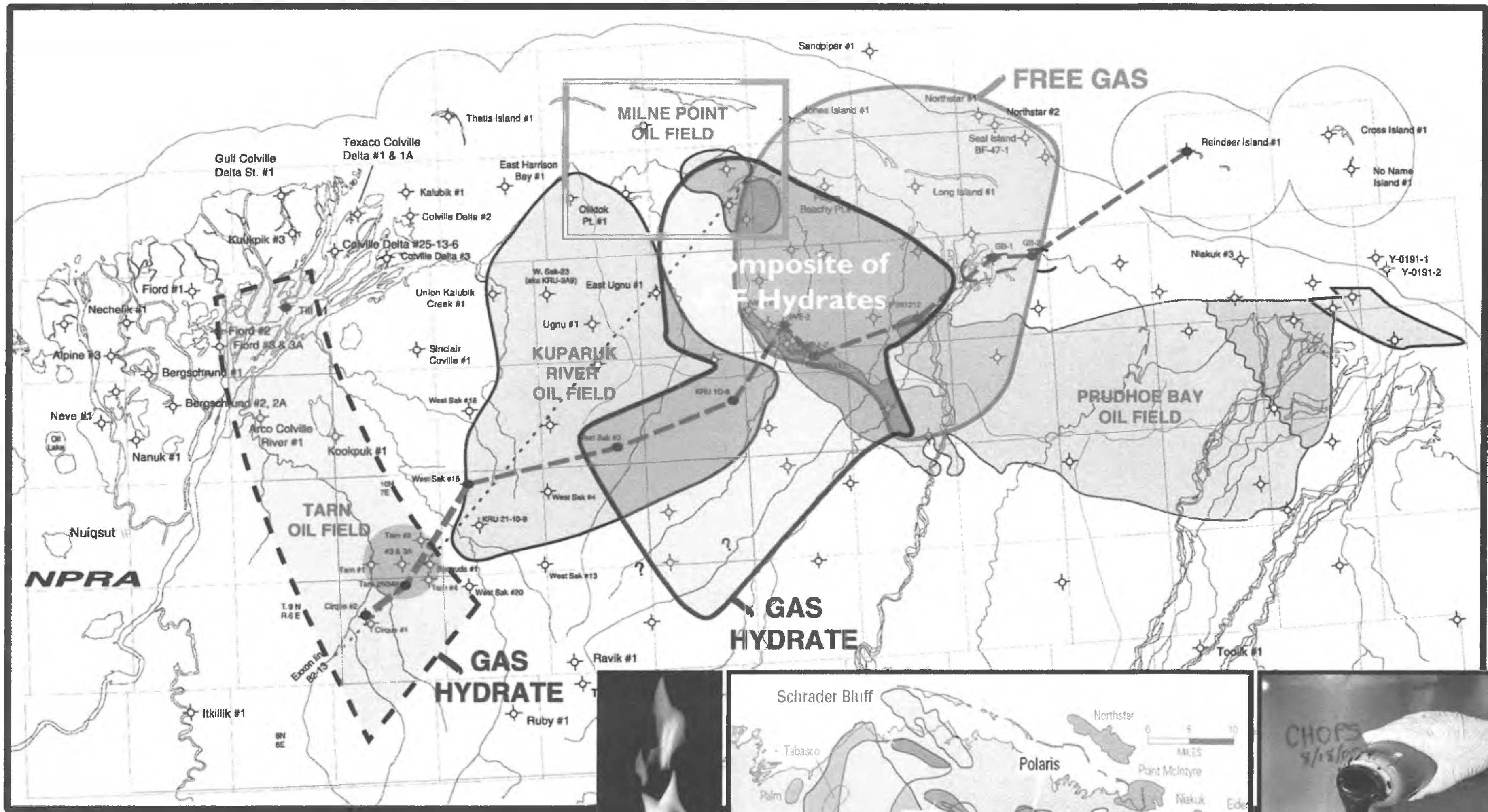
BP Exploration (Alaska) Inc.

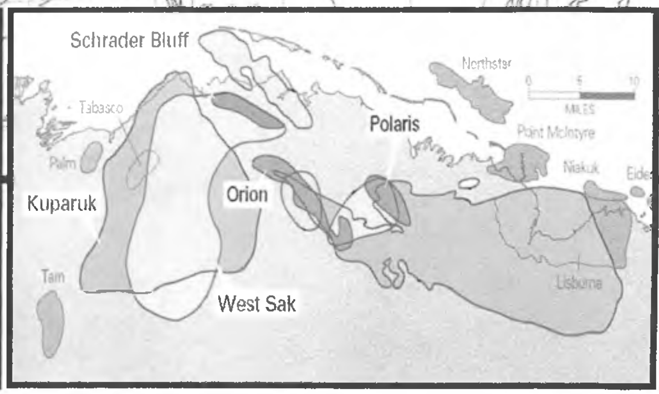
NETL-US DOE

Vision:

Through integrated academic, industry, & government collaborative research to promote safe, low cost, & environmentally responsible production of abundant, strategic resources and secure energy needs of the State of Alaska and the nation.

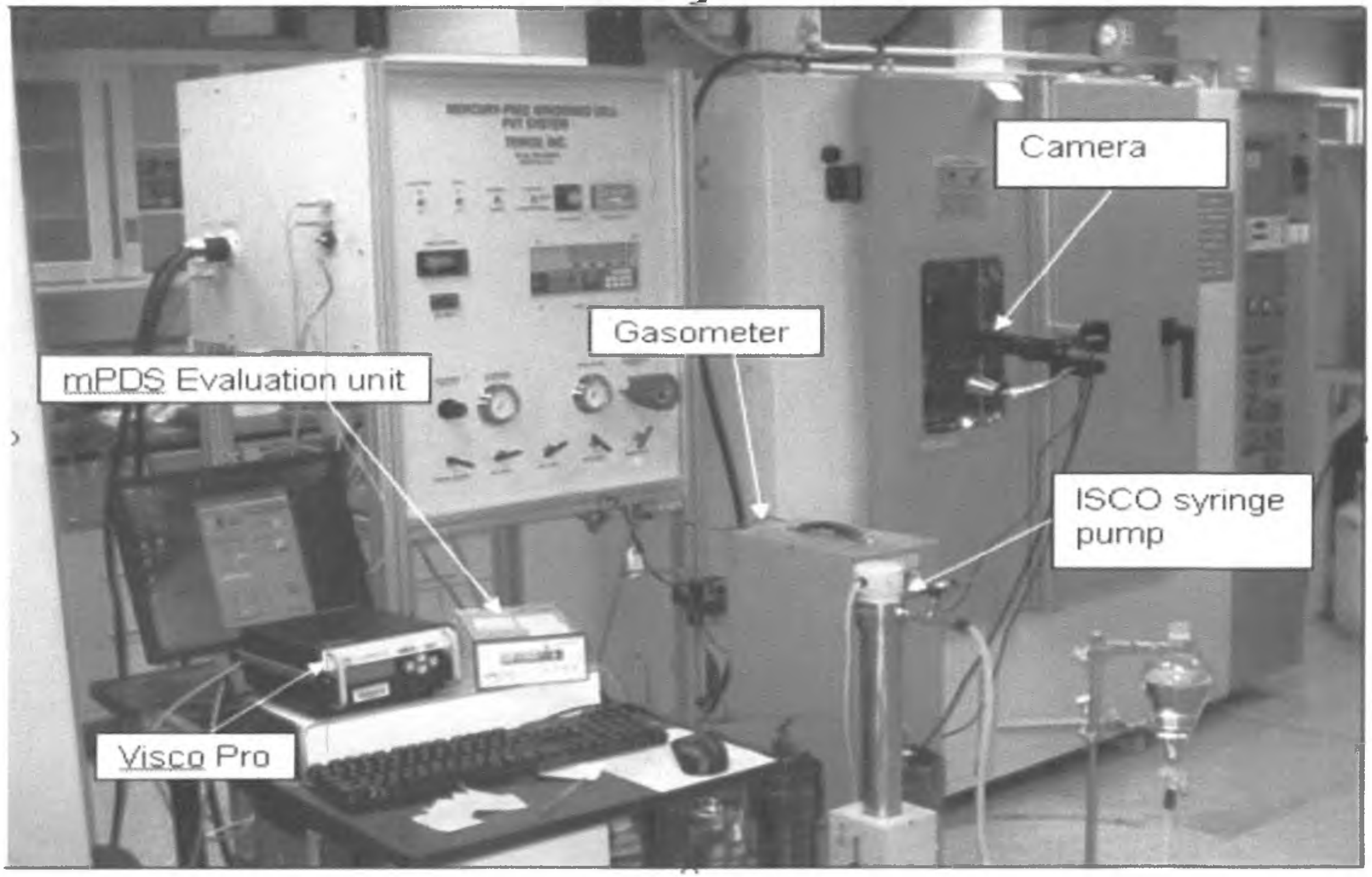
ANS Heavy Oil and Gas Hydrate Resources





Collett et al., 2004 and BPXA, and NETL-USDOE

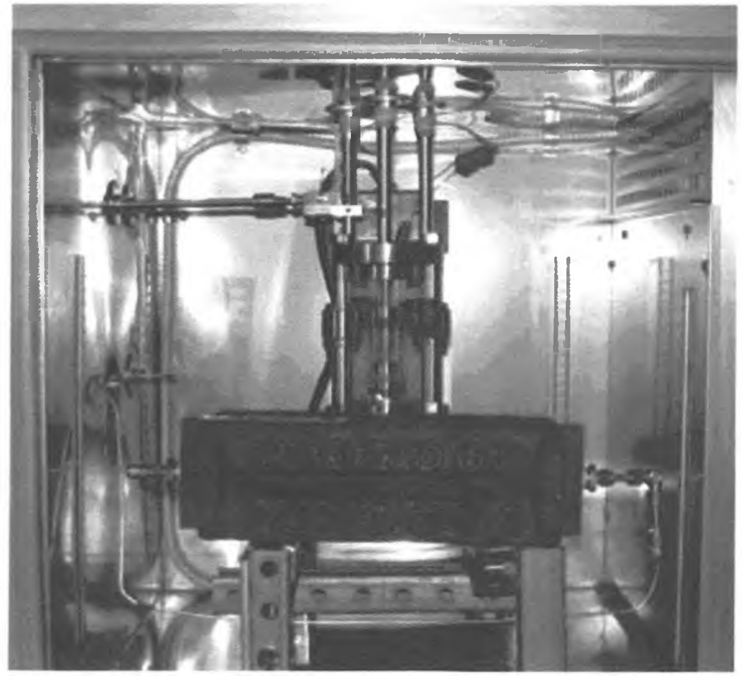
Integrated PVT Rig for Fluid Phase Behavior Including Online Density and Viscosity Meter



Operating limits: can handle upto 7500 psia and 350 deg F

Phase Behavior Rig for Hydrate Studies

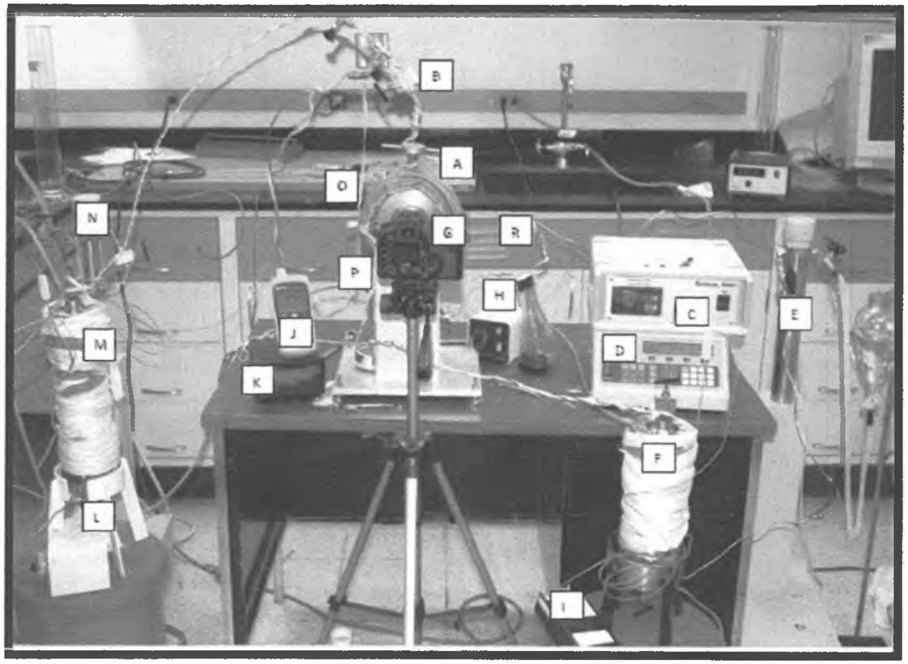
DBR hydrate phase behavior set-up for bulk hydrate

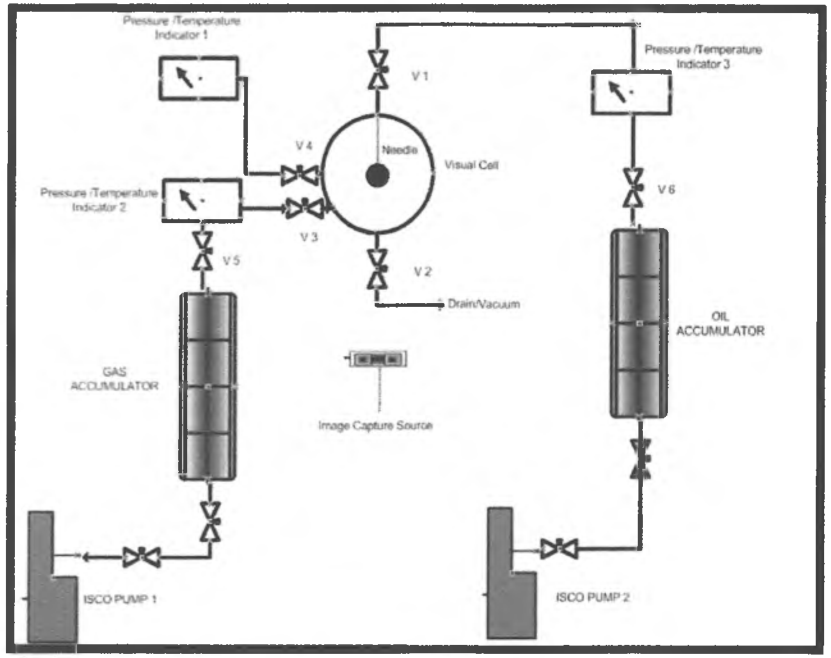


Set-up for hydrate studies in porous media

Operating limits: can handle upto 3000 psia and -94 to 392 deg F

Vanishing IFT and Coreflooding Set-ups



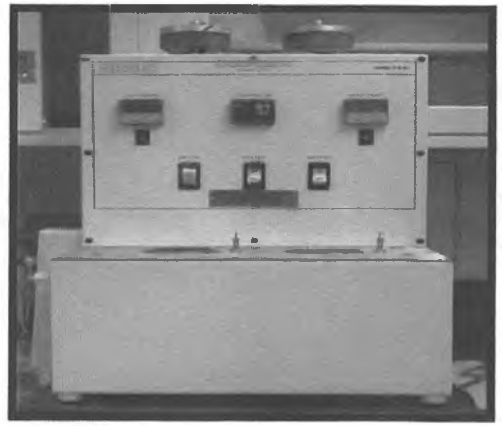


Core Flooding Rig 4 for Formation Damage Studies

Operating limits: can handle upto 5000 psia and 350 deg F

Chandler 1910 HPHT Curing Chamber

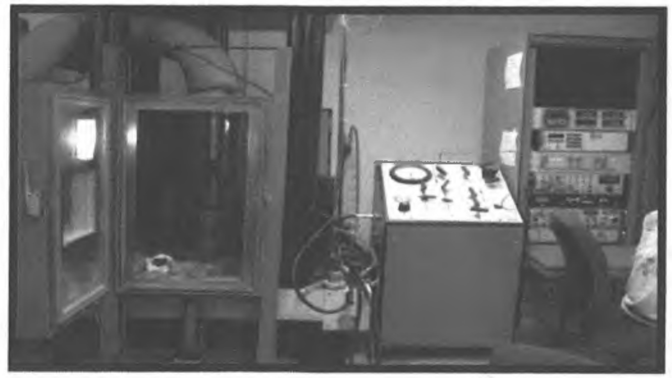
Chandler 8340 HPHT Consistometer



Chandler Atmospheric Consistometer

Chandler 4265-HT UCA (Ultrasonic Cement Analyzer)

HPHT Filter Press (fluid loss)

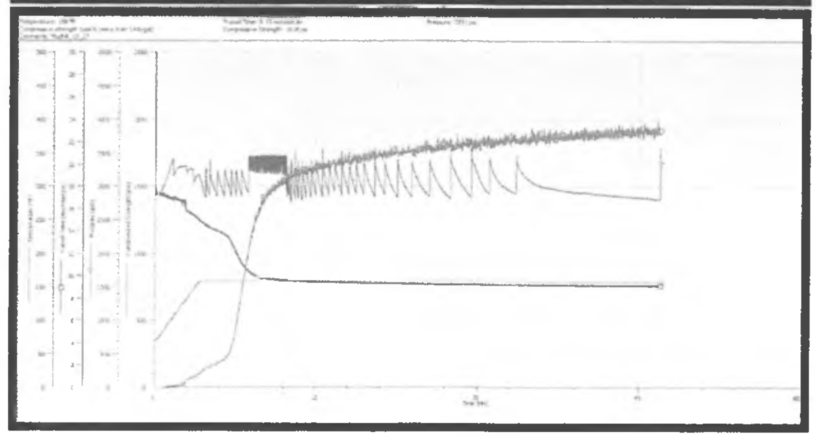


Uniaxial Loading Rock Mechanics Lab

Cement Testing Equipment

The Cement Testing Laboratory is newly equipped to determine properties of cement under range of pressure and temperature conditions.

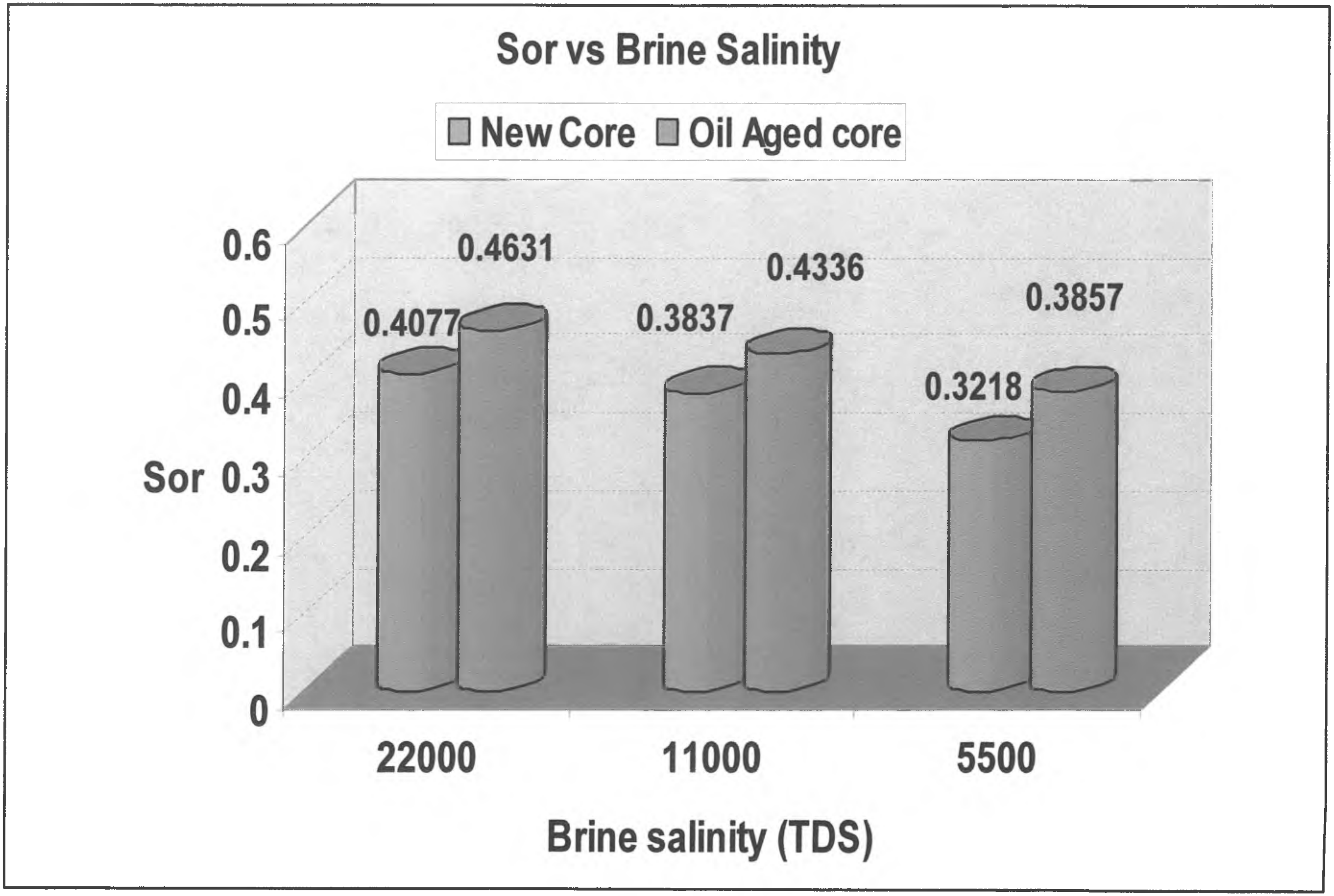
HPHT Consistometer and Curing Chamber used simulate well temperatures and pressures.



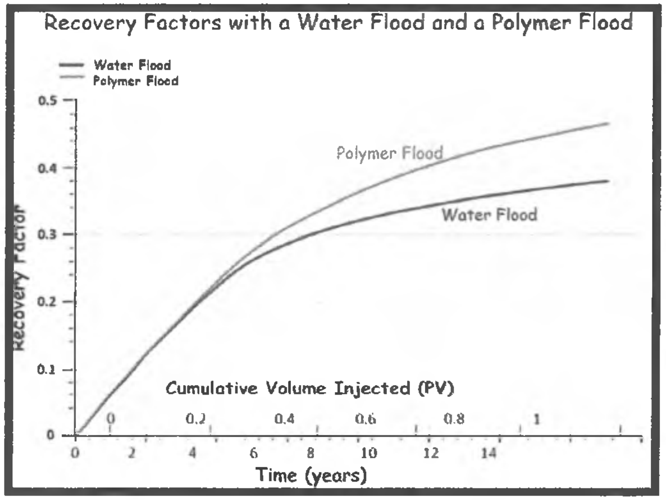
Ultrasonic Cement Analyzer: Provides real time compressive strength data

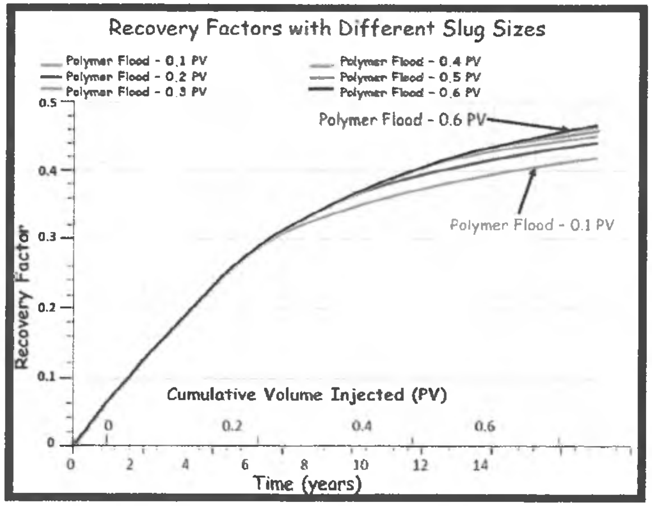
HPHT equipment- test temperature up to 600°F and pressures of 30,000 psi

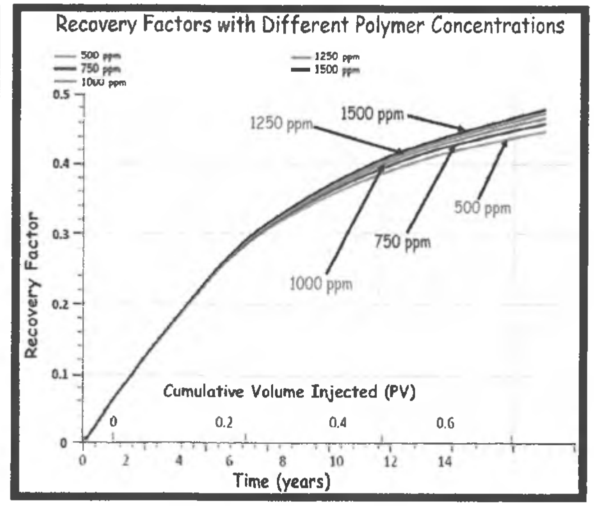
LOW SALINITY WATERFLOODS

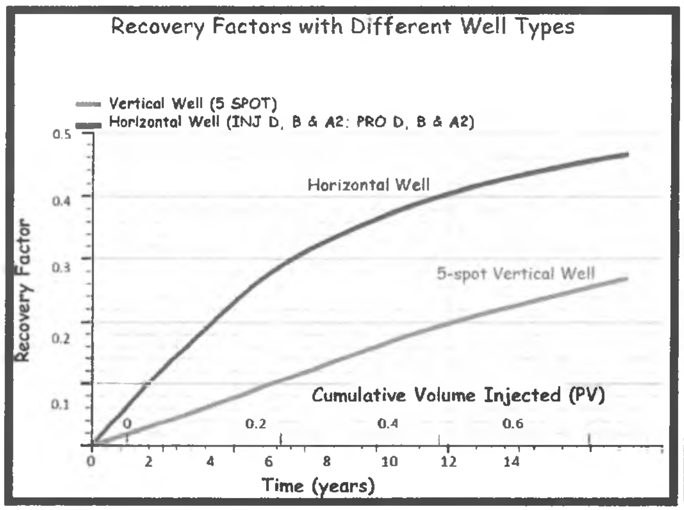


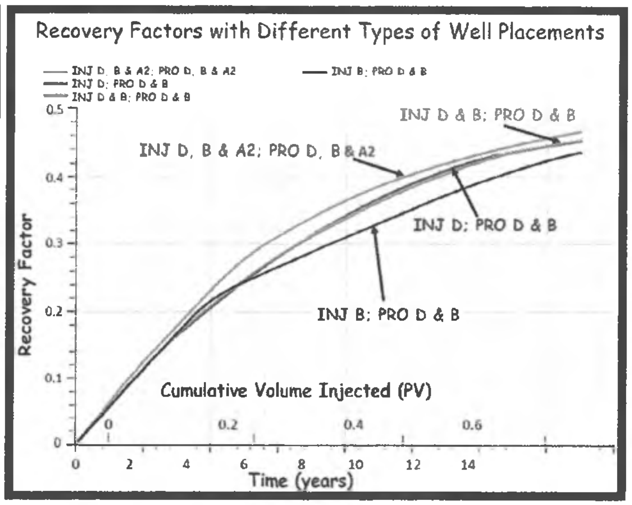
Chemical Flooding

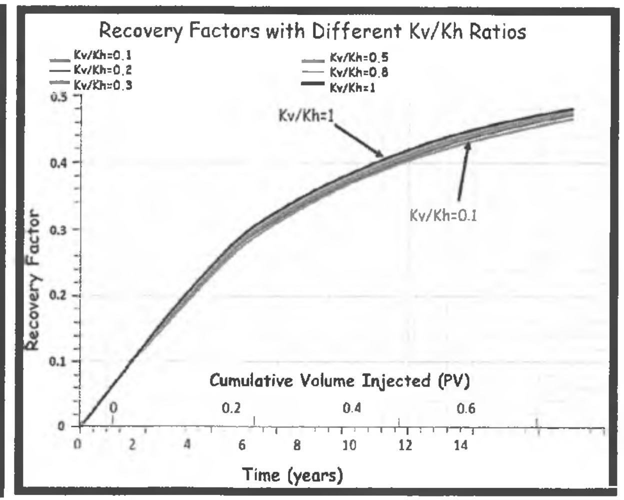




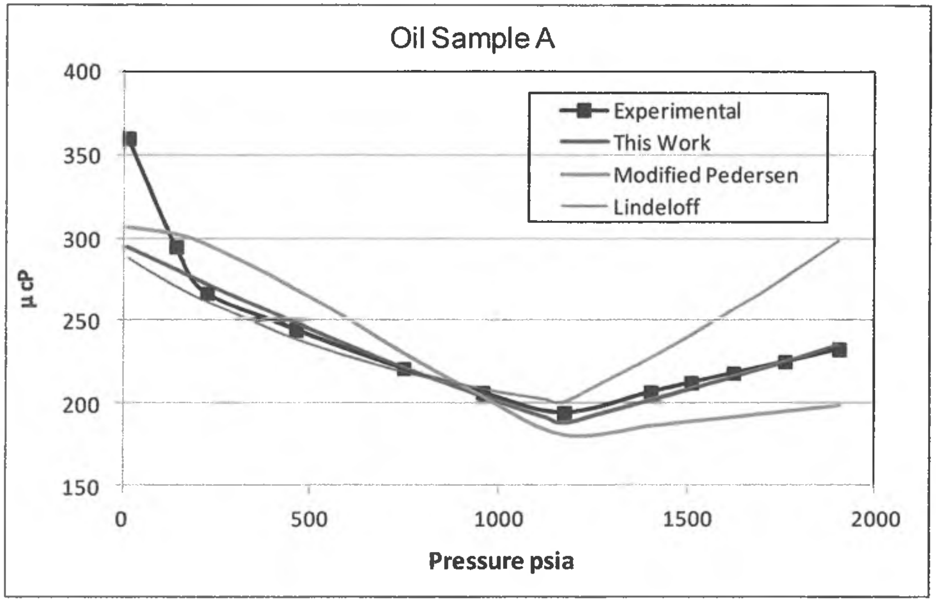




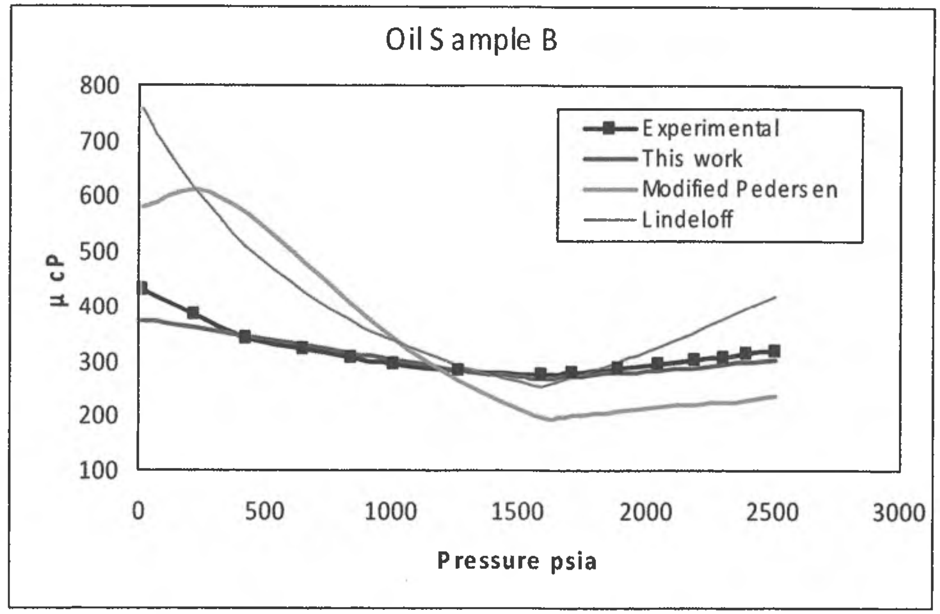




Application of Compositional Viscosity Models



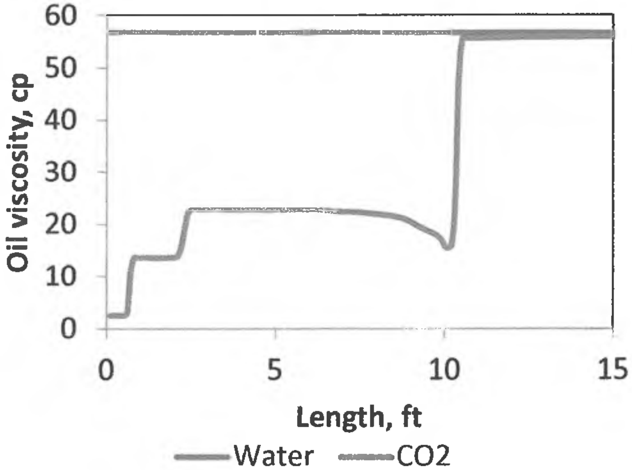
Oil A , Average To=40.15K



Oil B , Average To=42.44 K

% Average absolute deviation	Modified Pedersen	Lindeloff	This Work
Oil Sample A	10.868	9.196	3.078
Oil Sample B	37.266	44.673	4.292

CO2-EOR Sequestration in Heavy Oil Reservoir

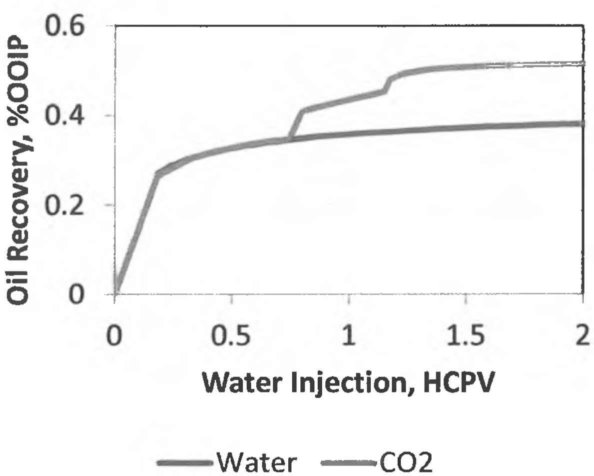


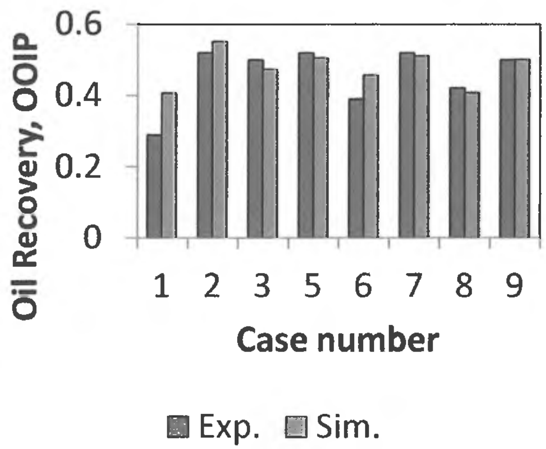
Case Number	K (md)	Porosity (%)	Sw_i (%)	
1	500	20.1	25.0	Waterflooding
2	500	20.3	26.0	1.48 HCPV liquid CO_2
3	500	20.1	25.0	0.72 HCPV liquidCO_2
5	500	20.4	27.2	0.17 HCPV liquid CO_2 (wag)
6	1500	27.6	17.6	Waterflood
7	1500	26.8	19.7	0.09 HCPV liquid CO_2 (wag)
8	1500	27.6	24.5	Waterflood (T=100°F)
9	1500	26.8	20.8	0.08 Gaseous CO_2 + Waterflood (T=100°F)

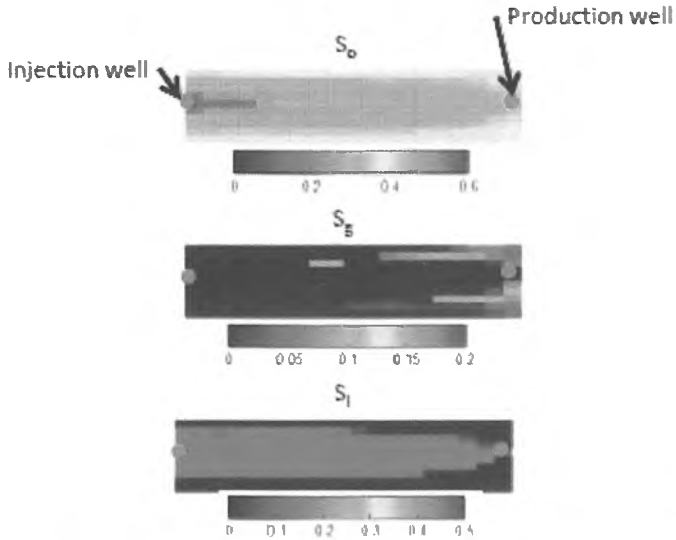
Objective: Quantify the amount of CO_2 than can be stored in Alaska oil reservoirs

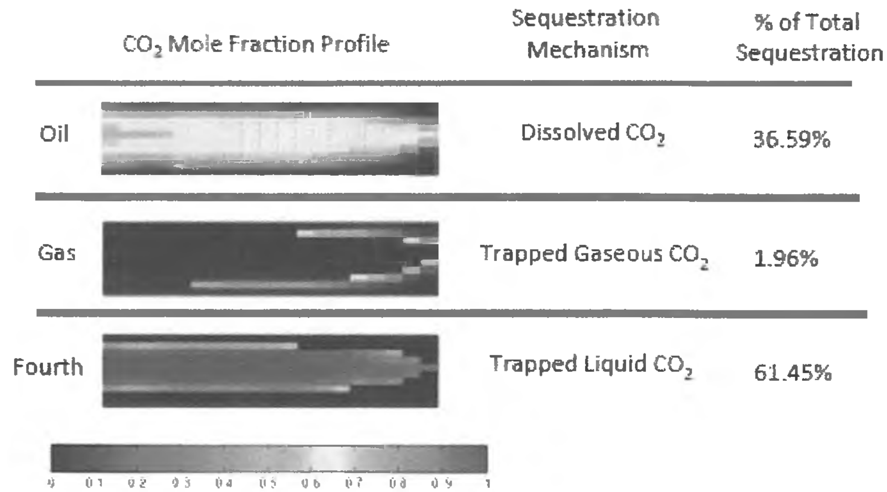
This is a multi-disciplinary research, with focus on how and how much CO_2 can be sequestered and used as an EOR solvent.

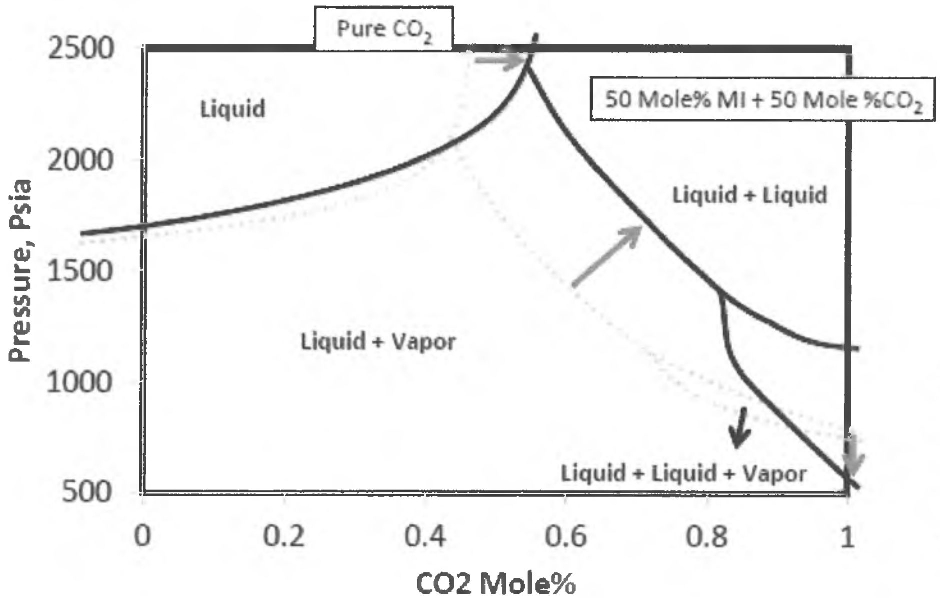
Investigating pure CO_2, enriched CO_2 and CO_2-WAG injection for ANS reservoir

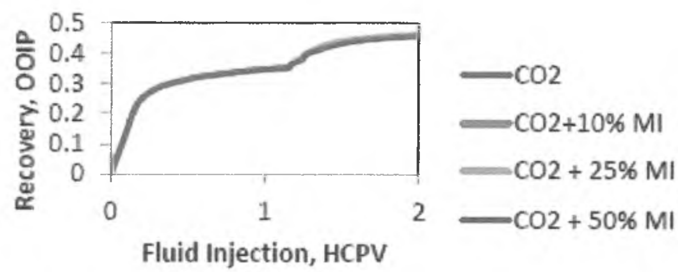


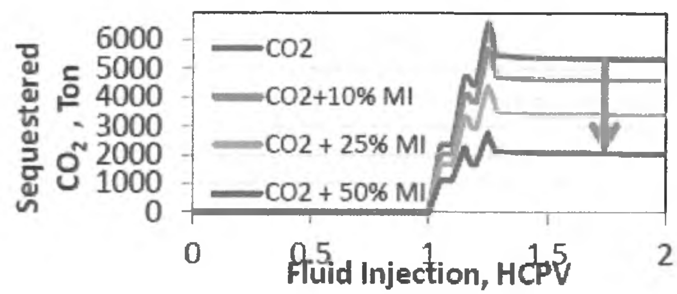



Production well
Injection well
S_o
0 0.2 0.4 0.6
S_g
0 0.05 0.1 0.15 0.2
S_l


CO_2 Mole Fraction Profile
Sequestration Mechanism
% of Total Sequestration
Oil
Dissolved CO_2
36.59%
Gas
Trapped Gaseous CO_2
1.96%
Fourth
Trapped Liquid CO_2
61.45%


Pure CO_2
50 Mole% MI + 50 Mole %CO_2
Liquid
Liquid + Liquid
Liquid + Vapor
Liquid + Liquid + Vapor
Pressure, Psia
2500
2000
1500
1000
500
0
0.2
0.4
0.6
0.8
1
CO2 Mole%


Recovery, OOIP
0.5
0.4
0.3
0.2
0.1
0
0
1
2
Fluid Injection, HCPV
CO2
CO2+10% MI
CO2 + 25% MI
CO2 + 50% MI

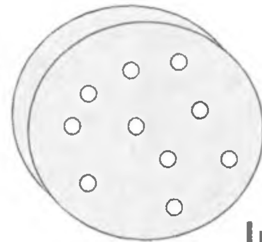

Sequestered CO_2, Ton
6000
5000
4000
3000
2000
1000
0
CO2
CO2+10% MI
CO2 + 25% MI
CO2 + 50% MI
0
0.5
1
1.5
2
Fluid Injection, HCPV

MEOR

- Objective 1: Isolate and identify indigenous biosurfactant producing bacteria from 6 different ANS heavy oil reservoirs

Liquid enrichment cultures (incubated 1-3 months)

Spread bacteria onto agar plates



Inoculate 96-well plate with colonies

Optical distortion assay (Chen et al., 1997)

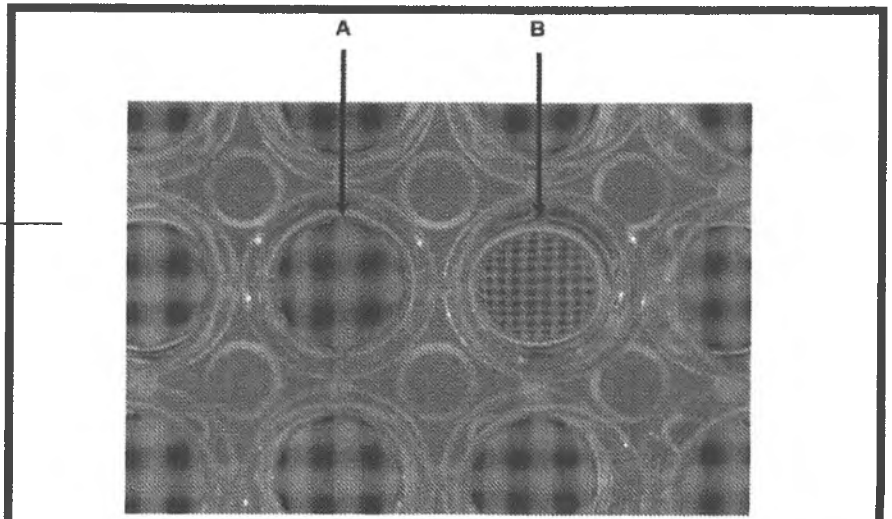


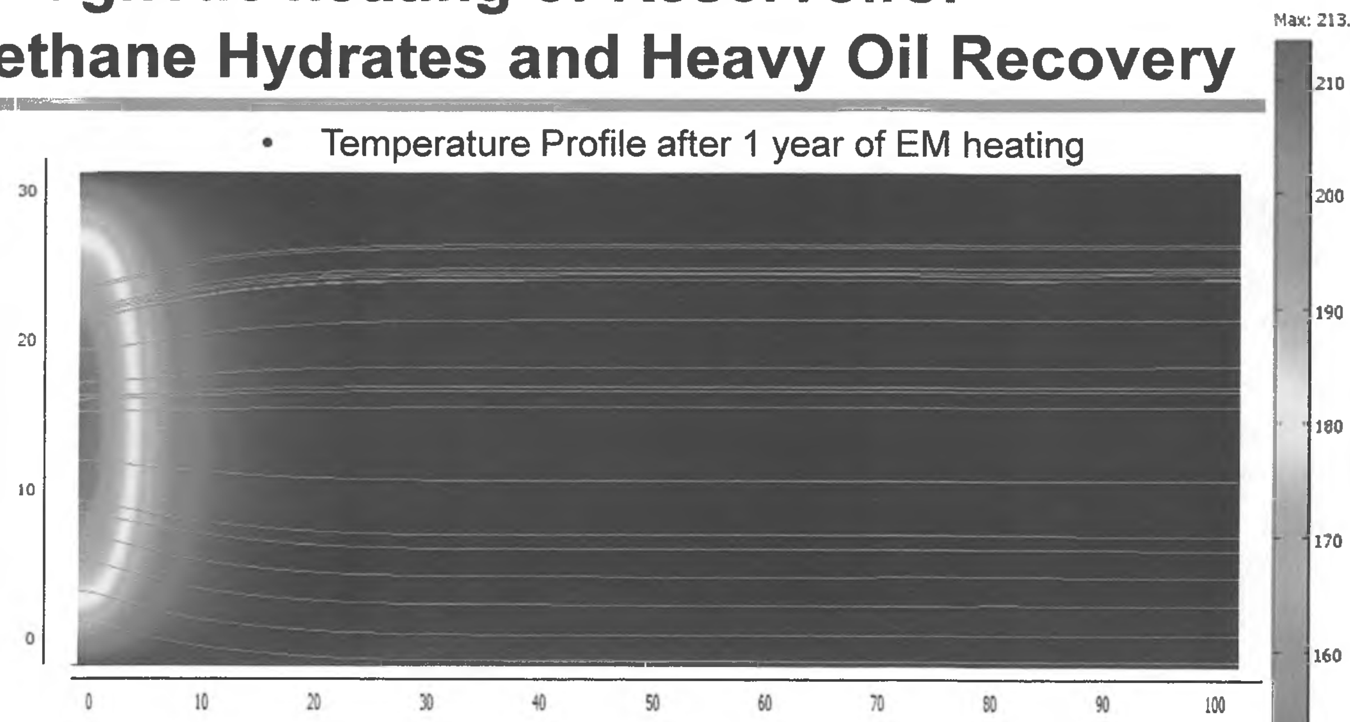
Fig. 3. Qualitative microplate assay of a high quality water control (A) and biosurfactant from strain BBK016 (B).

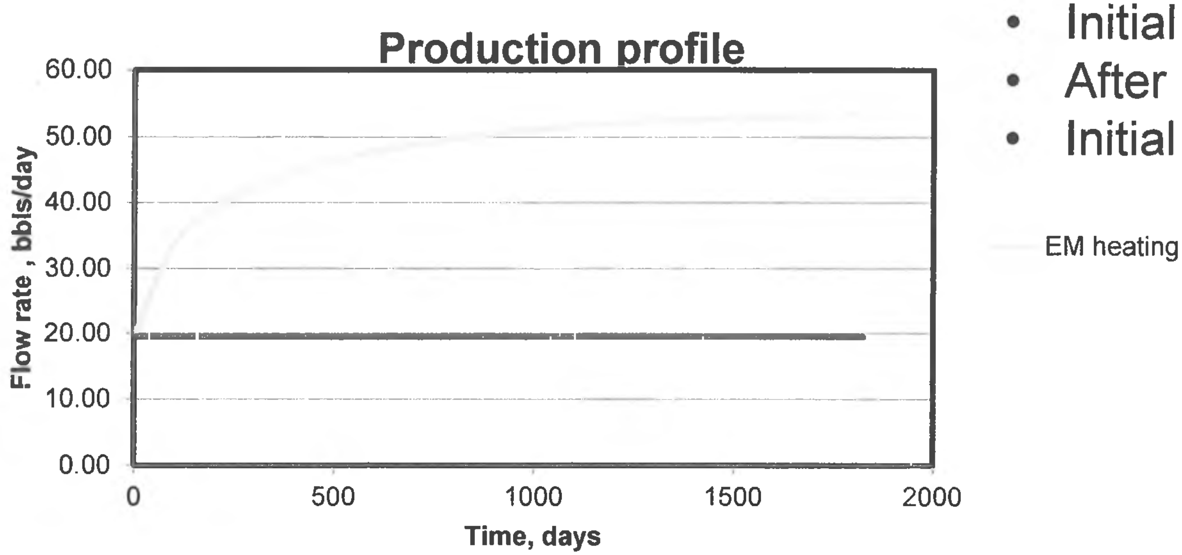
Isolate and identify positive organisms

Electromagnetic heating of Reservoirs: Application to Methane Hydrates and Heavy Oil Recovery

- Good well stimulation technique for heavy oil reservoirs on the ANS.
- Can be applied to dissociate methane hydrates and unlock the gas.

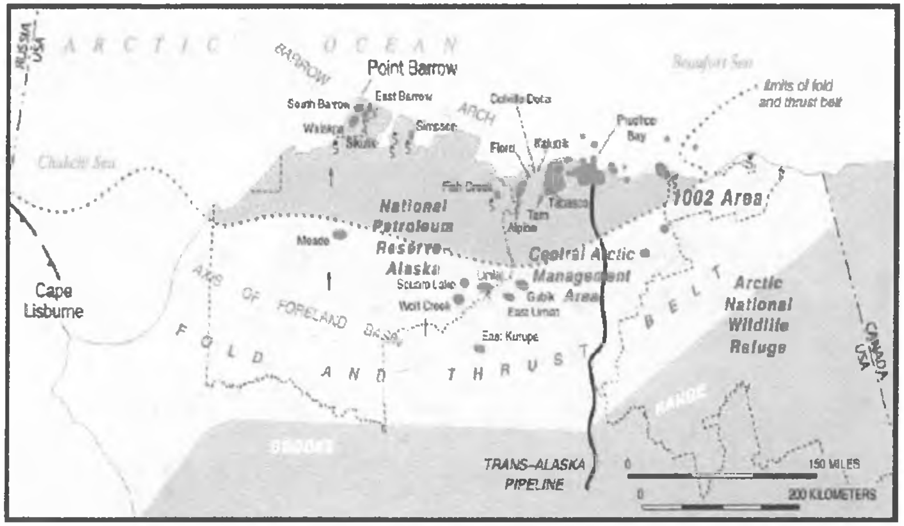
- Temperature Profile after 1 year of EM heating





- Initial Viscosity ~ 3000cp
- After 1 year of heating ~ 96cp
- Initial Temperature = 120 ^{0}F

UMIAT- Challenges and Opportunities



Why Umiat?

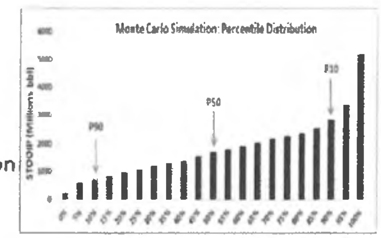
- Large proven shallow oil accumulation (7500 acres) with large OOIP
- Unique circumstance of having a light oil (37 API in sub-freezing (24-36 F) temperature) reservoir at shallow depth – 200 to 1300 ft
- Good pre-existing database – logs and core from 12 wells: relatively small geologic risk
- Reservoir and oil properties conducive to pressure maintenance using cold gas injection
- Proven multilateral well drilling technology for production at commercial rates
- An extremely high oil price is not necessary for commerciality

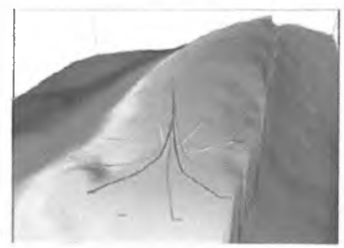
Development Challenges

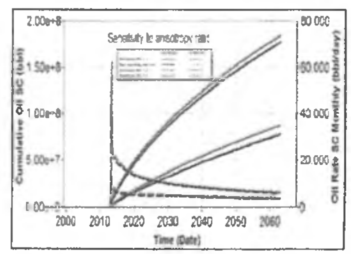
- Understanding fluid flow behavior in the presence of frozen bound water i.e. ice around the sand grains
- Maintaining the stability of the pore system with the injection of gas, air or liquid for pressure maintenance
- Effect of dislodging of ice crystals from the pores under increased pressure during injection on oil recovery
- Reduction in permeability to rock as a result of frozen water
- Attain infrastructure access

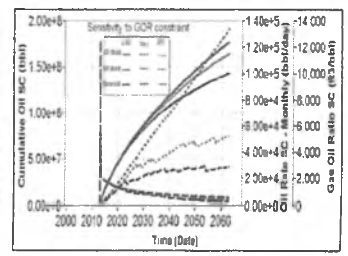
Umiat Field Development Study

OOIP estimate and simulation of gas injection

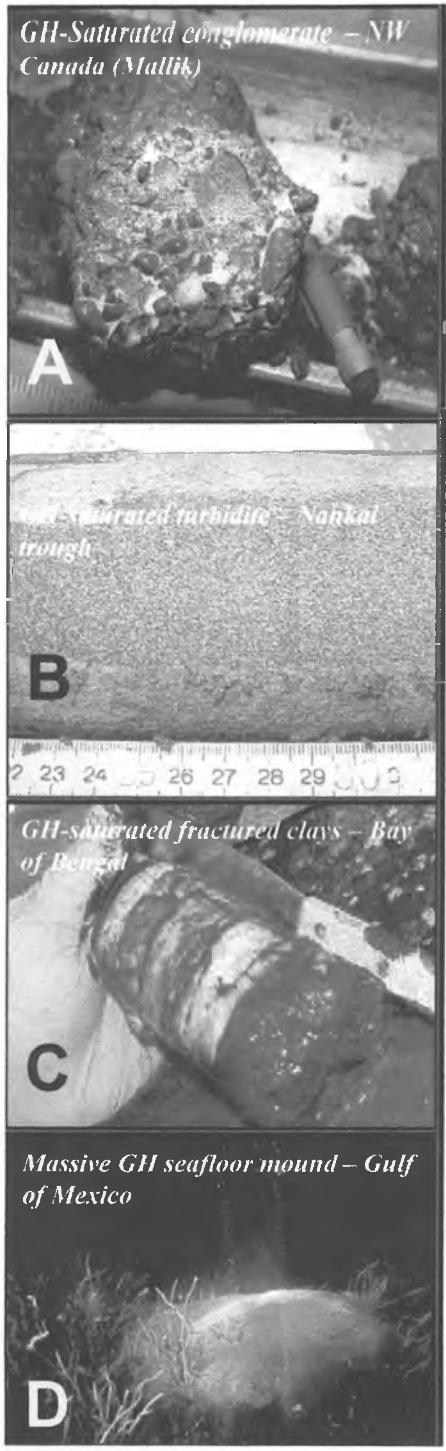


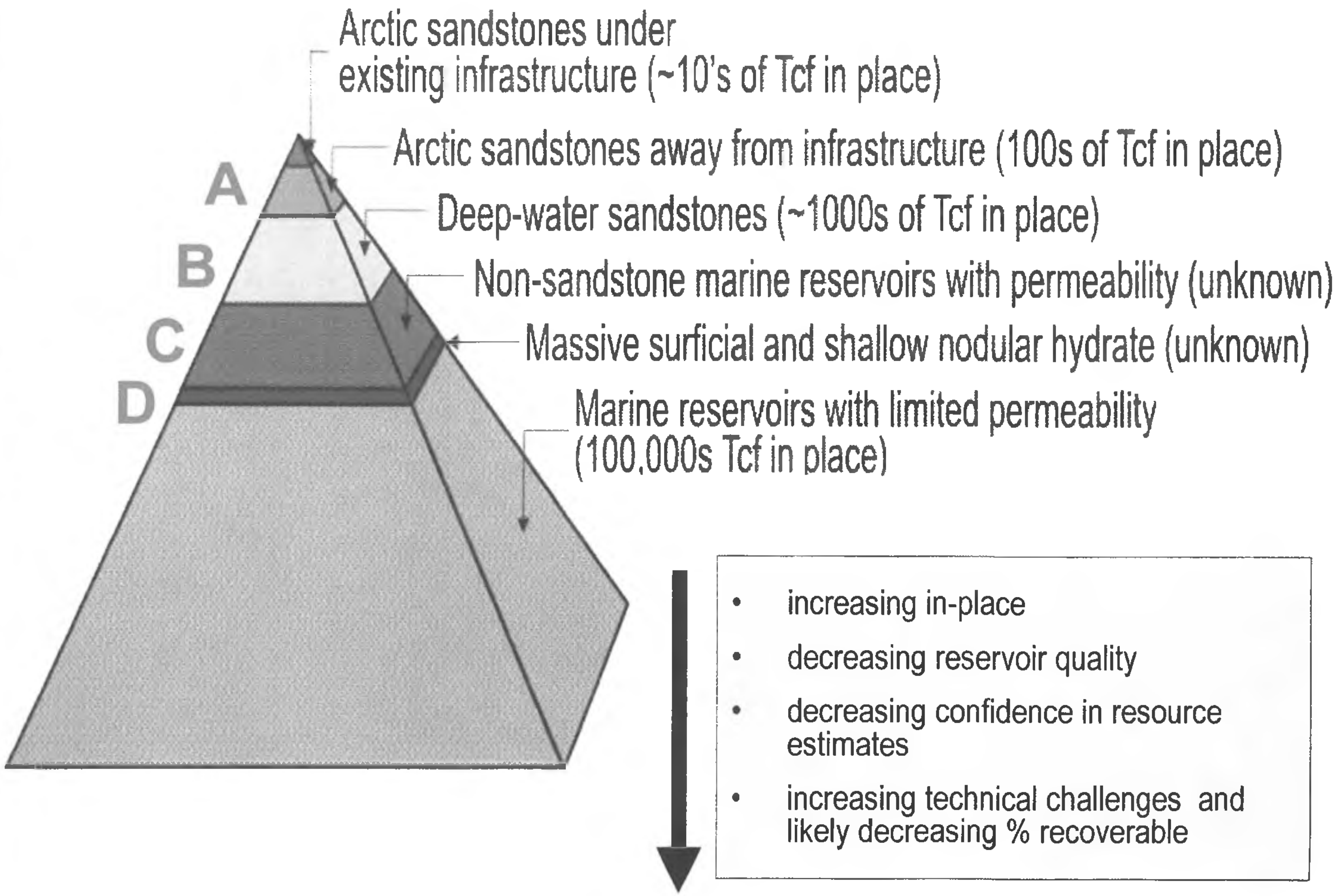






The Gas Hydrate Resource Pyramid

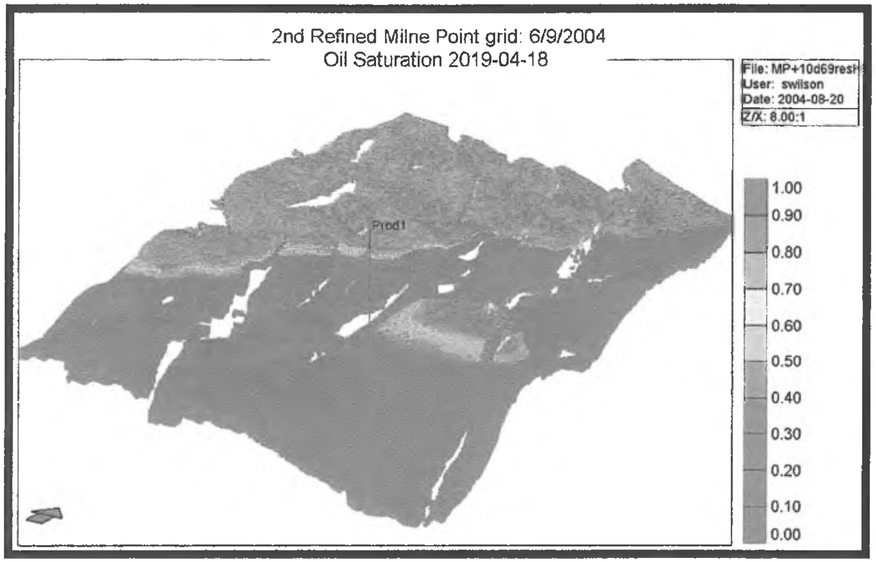


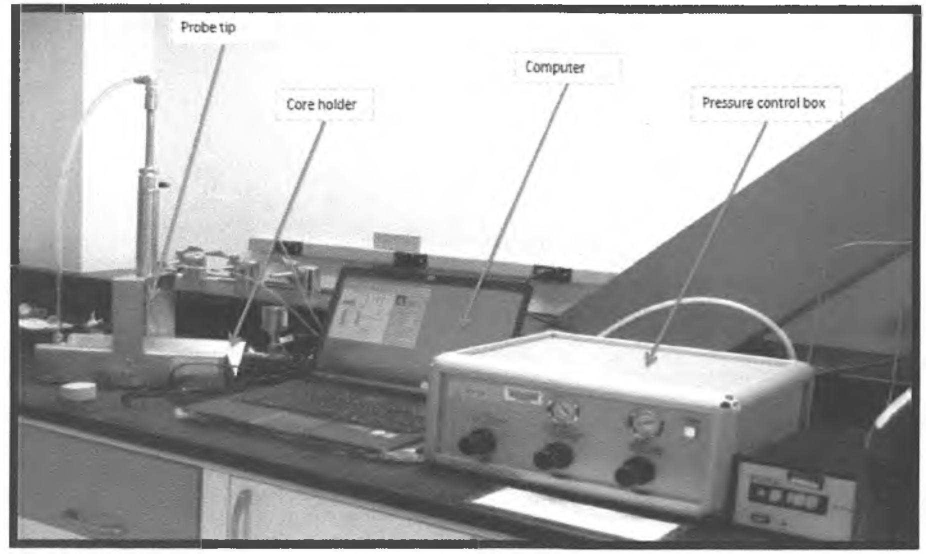


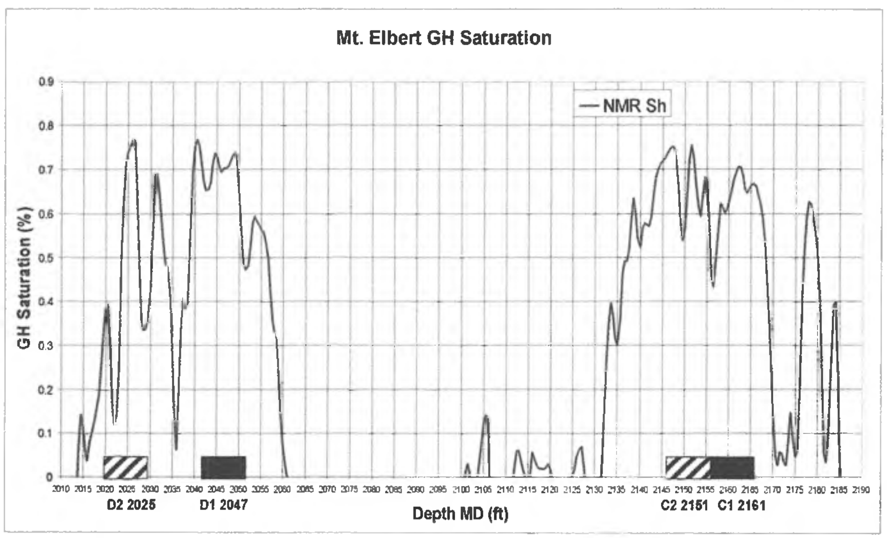
- increasing in-place
- decreasing reservoir quality
- decreasing confidence in resource estimates
- increasing technical challenges and likely decreasing % recoverable

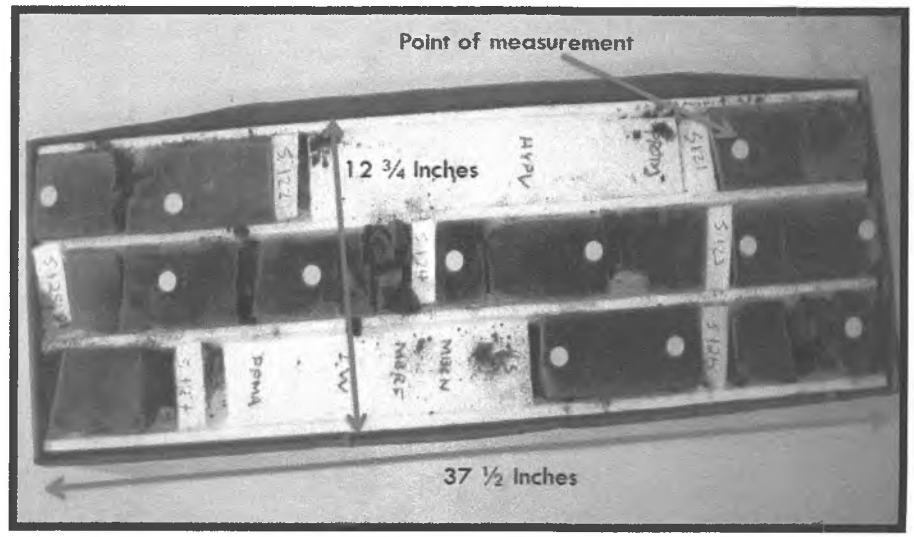
NETL- USDOE

Gas Hydrate Production Modeling

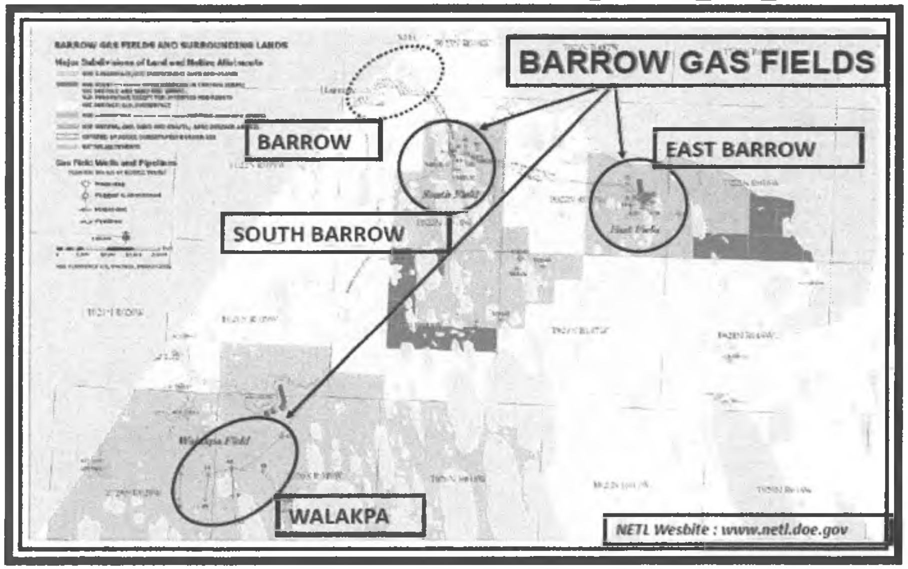


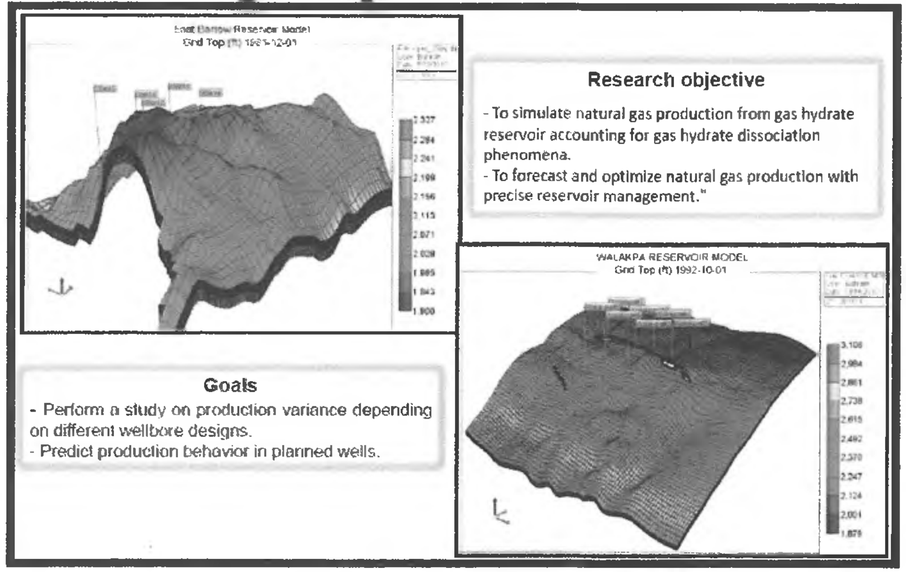


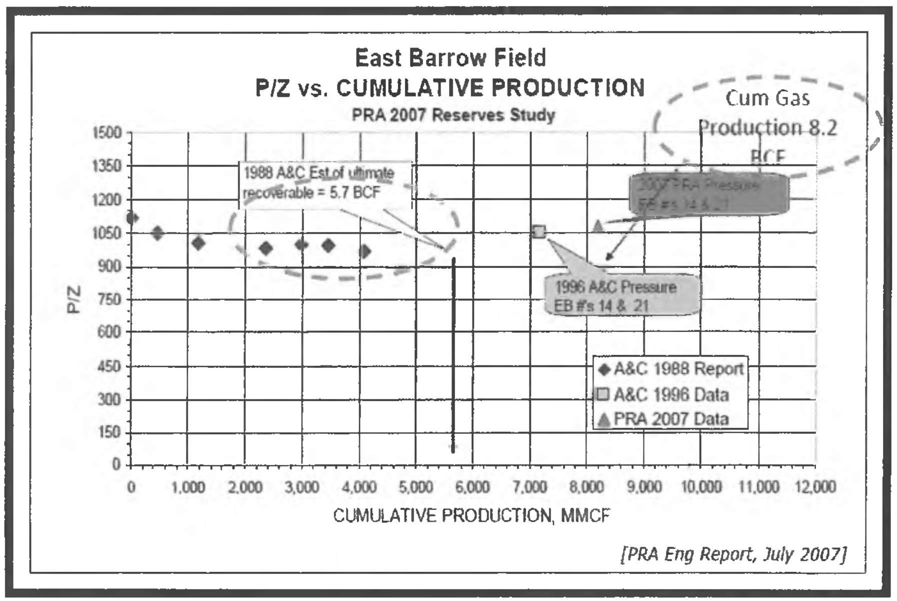


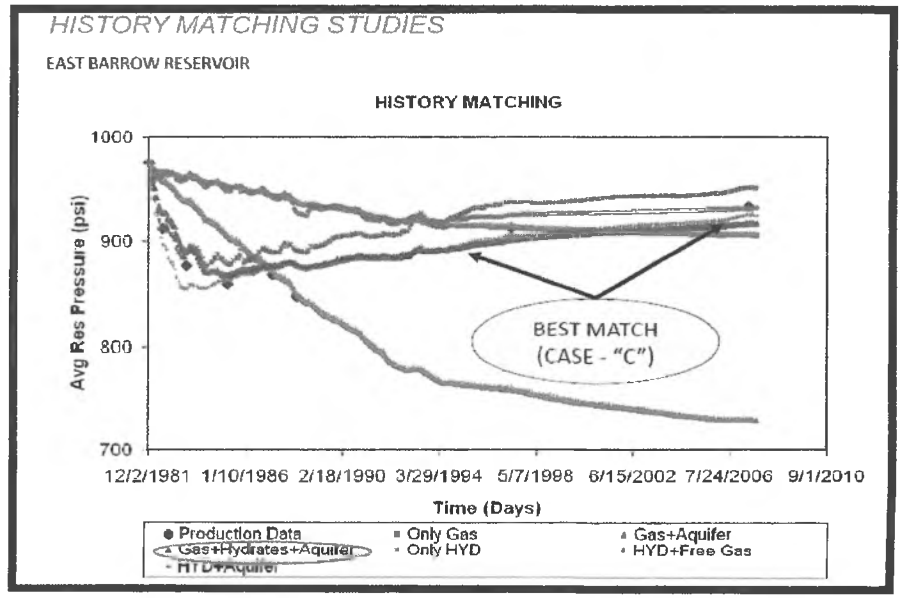


Barrow Gas Hydrates (Opportunity?)

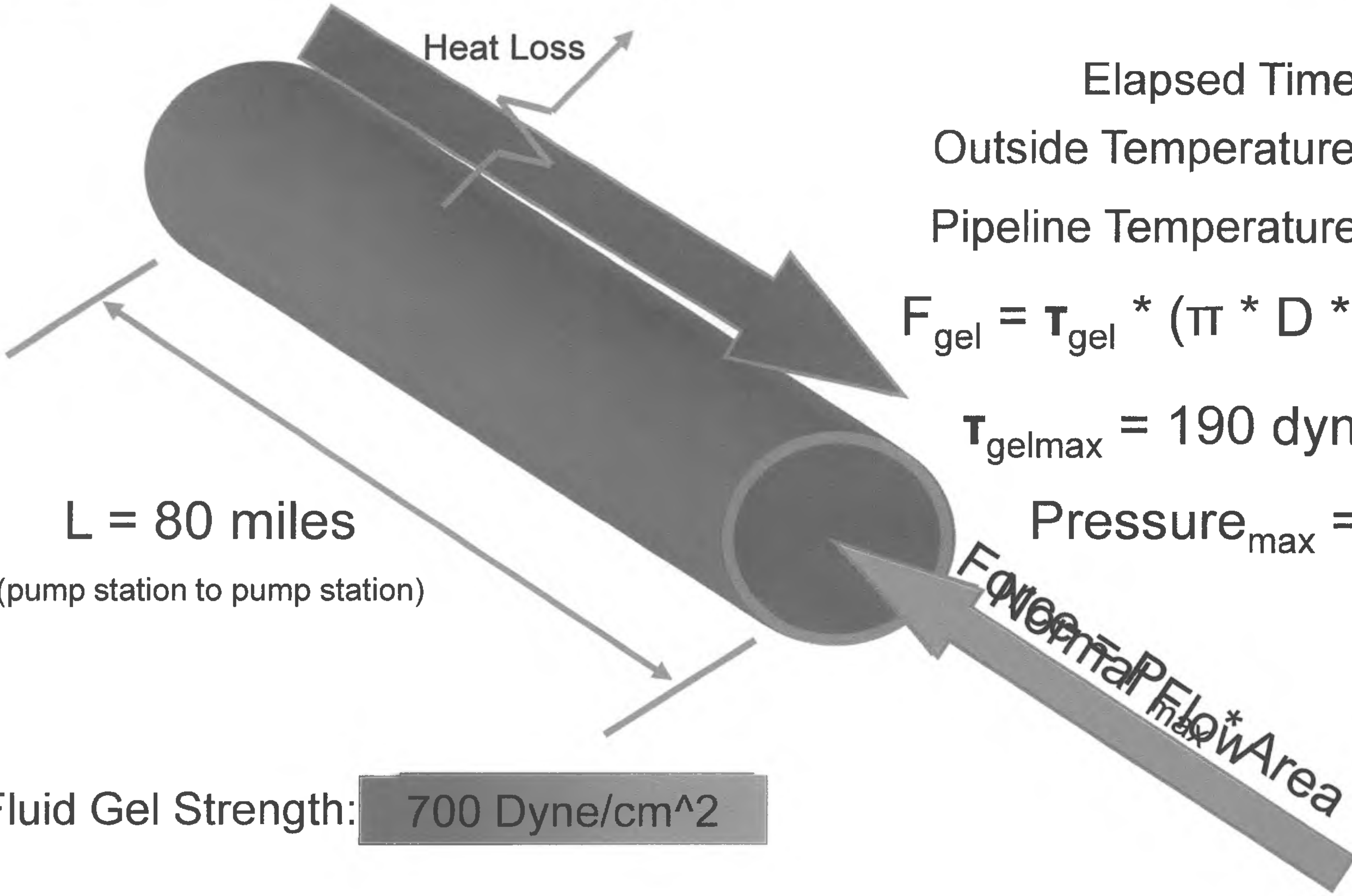








GTL: The Gel Strength Problem



Elapsed Time: Day 15

Outside Temperature: -40°F

Pipeline Temperature: 0°F

$F_{gel} = \tau_{gel} * (\pi * D * L)$

τ_{gelmax} = 190 dyne/cm^2

$Pressure_{max}$ = 1200 psi

Fluid Gel Strength: 700 Dyne/cm^2

Restart Impossible!

No Flow Condition

Miscible Injectant (MI) and CO_2 for Enhanced Recovery of Heavy Oil

Moving Closer to Producing Alaska's Heavy Oil

John Cheshire

Undergraduate Research Assistant
Phase Behavior Project Lead
Petroleum Development Laboratory
University of Alaska Fairbanks

Alaska's Heavy Oil Resources

What is heavy oil?

- Flows like syrup
- More dense than conventional oil

Where is it found in Alaska?

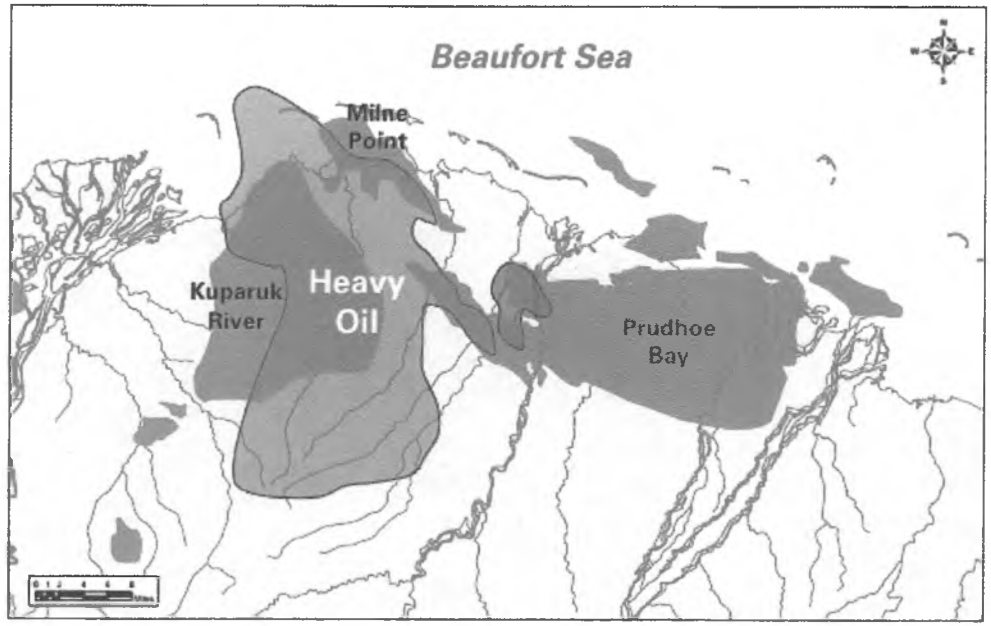
- On North Slope near conventional deposits
- Shallower depth than conventional oil

How much is there?

- 24 – 33 billion barrels

What's the challenge?

- High viscosity makes the oil difficult to produce economically



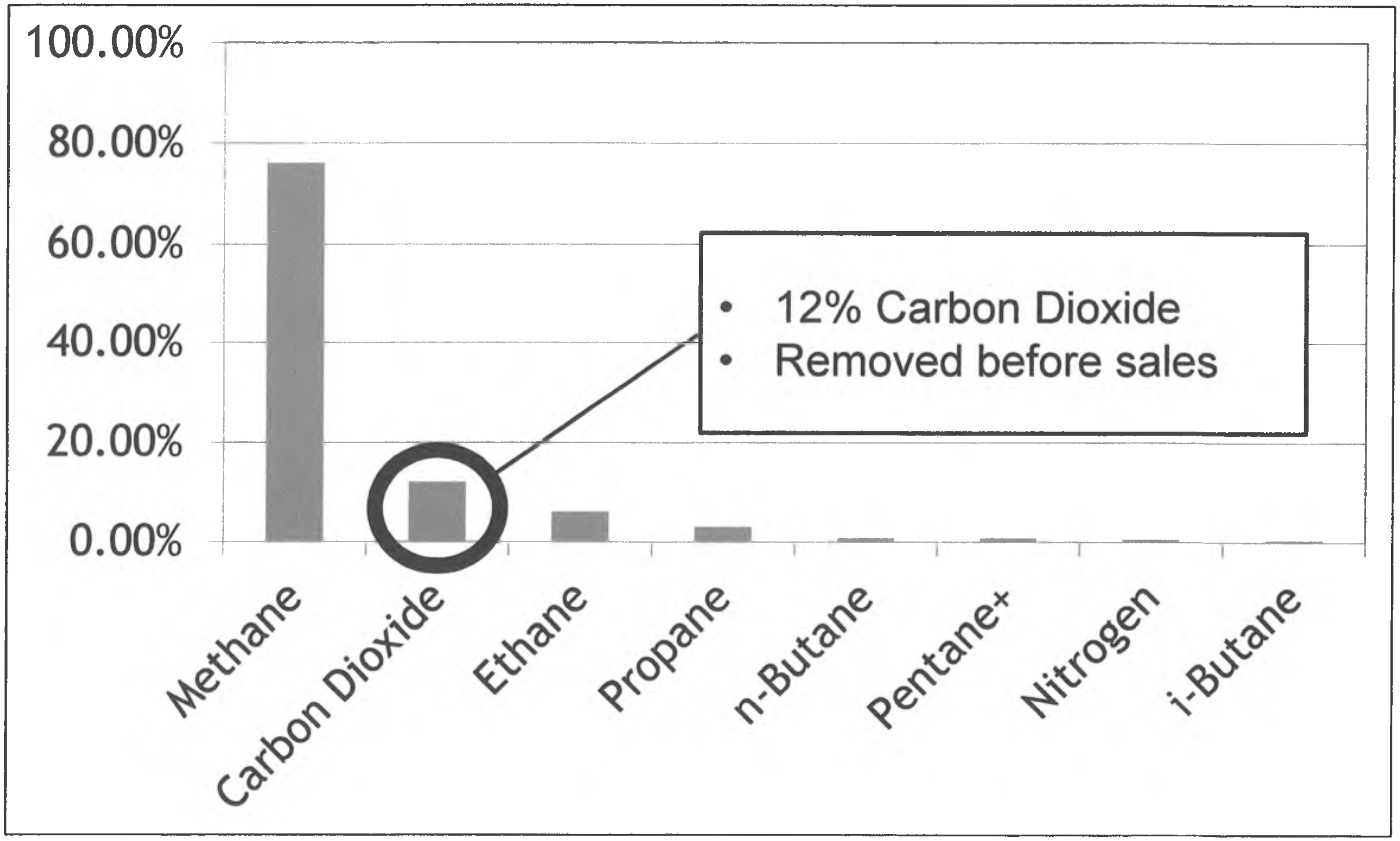
Location of Alaskan Heavy Oil (BP Exploration)

Enhanced Recovery of Heavy Oil

Methods:

- Water Flood
  - Low cost
  - Implemented on the Alaska North Slope (ANS)
  - Poor recovery efficiency
- Thermal
  - Injection of steam heats oil, helping it flow more easily
  - Arctic environment makes steam injection on ANS difficult
- Solvents
  - Mix with oil causing it to flow more easily
  - **Carbon dioxide** and light hydrocarbons are typical solvents
  - Could be available on ANS with gas sales
  - Research ongoing

Carbon Dioxide Content of ANS Gas

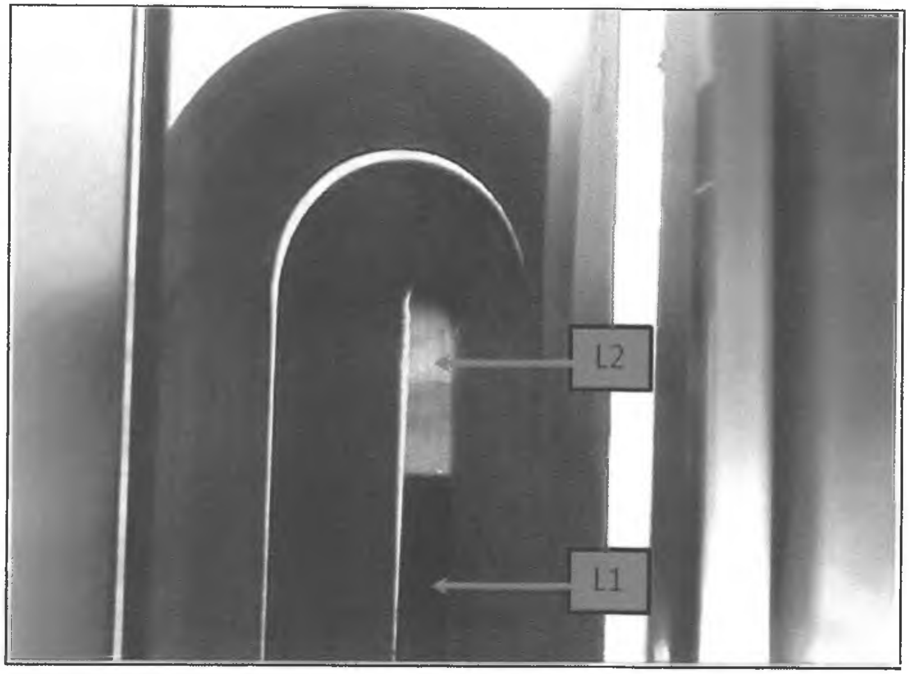


Alaska North Slope Gas Content (Transport of Natural Gas to Tidewater)

Research Background

Background:

- Blend of carbon dioxide and light hydrocarbons have potential to increase heavy oil recovery
- Numerical simulations are used to make development decisions
- Phase behavior of heavy oil when combined with carbon dioxide and light hydrocarbons is not well described numerically so difficult to simulate



Carbon Dioxide and Heavy Oil Forming Two Liquid Phases

Conclusions

- Ongoing research is step toward additional production of heavy oil resources from ANS
- Additional production would be boon to TAPS
- CO_2-MI blend would utilize existing ANS resources to increase heavy oil production
- Sequestration of carbon through injection of CO_2-MI blend

Future Research

- Identify CO_2-MI blend that eliminates formation of second liquid phase
- Measure density and viscosity of heavy oil in contact with optimized CO_2-MI blend
- Conduct slim-tube experiments to determine minimum miscibility pressure of optimized CO_2-MI blend
- Evaluate recovery potential of development scenarios using numerical simulator
- Tune or develop a numerical simulator to match empirical phase and property behavior

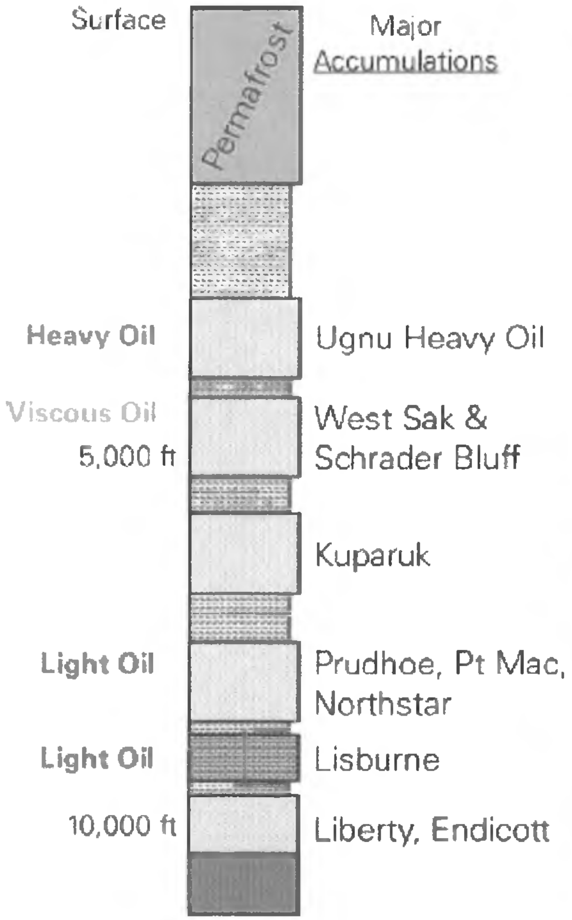
Protecting ANS Wells and Infrastructure from Permafrost Subsidence

Tom Polasek

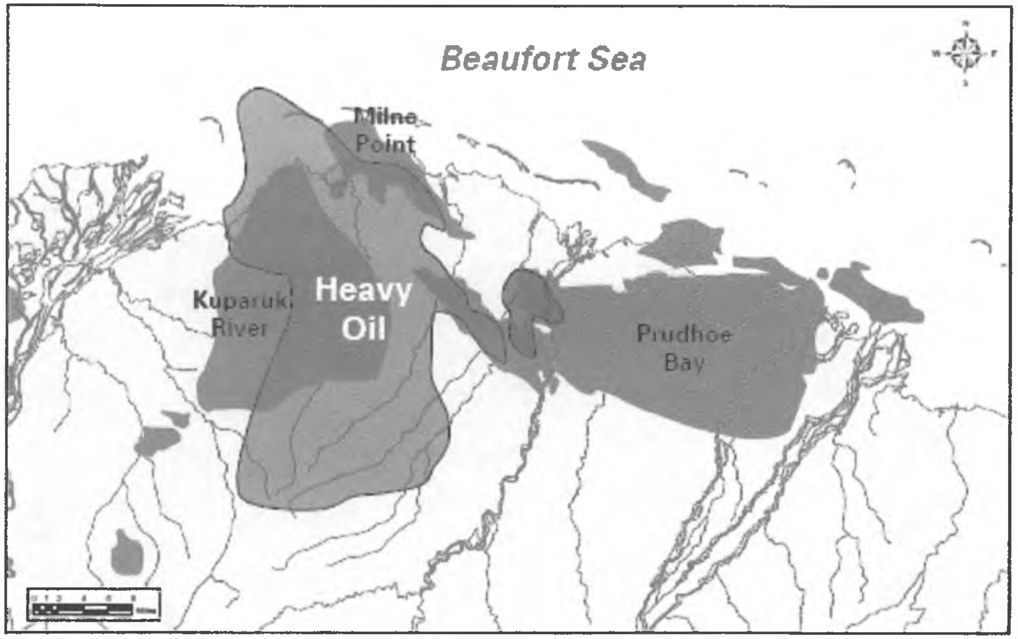
Undergraduate Research Assistant
Permafrost Subsidence Project Lead
Petroleum Development Laboratory
University of Alaska Fairbanks

Alaska Heavy Oil Resource

Alaska Viscous & Heavy Oil Resource

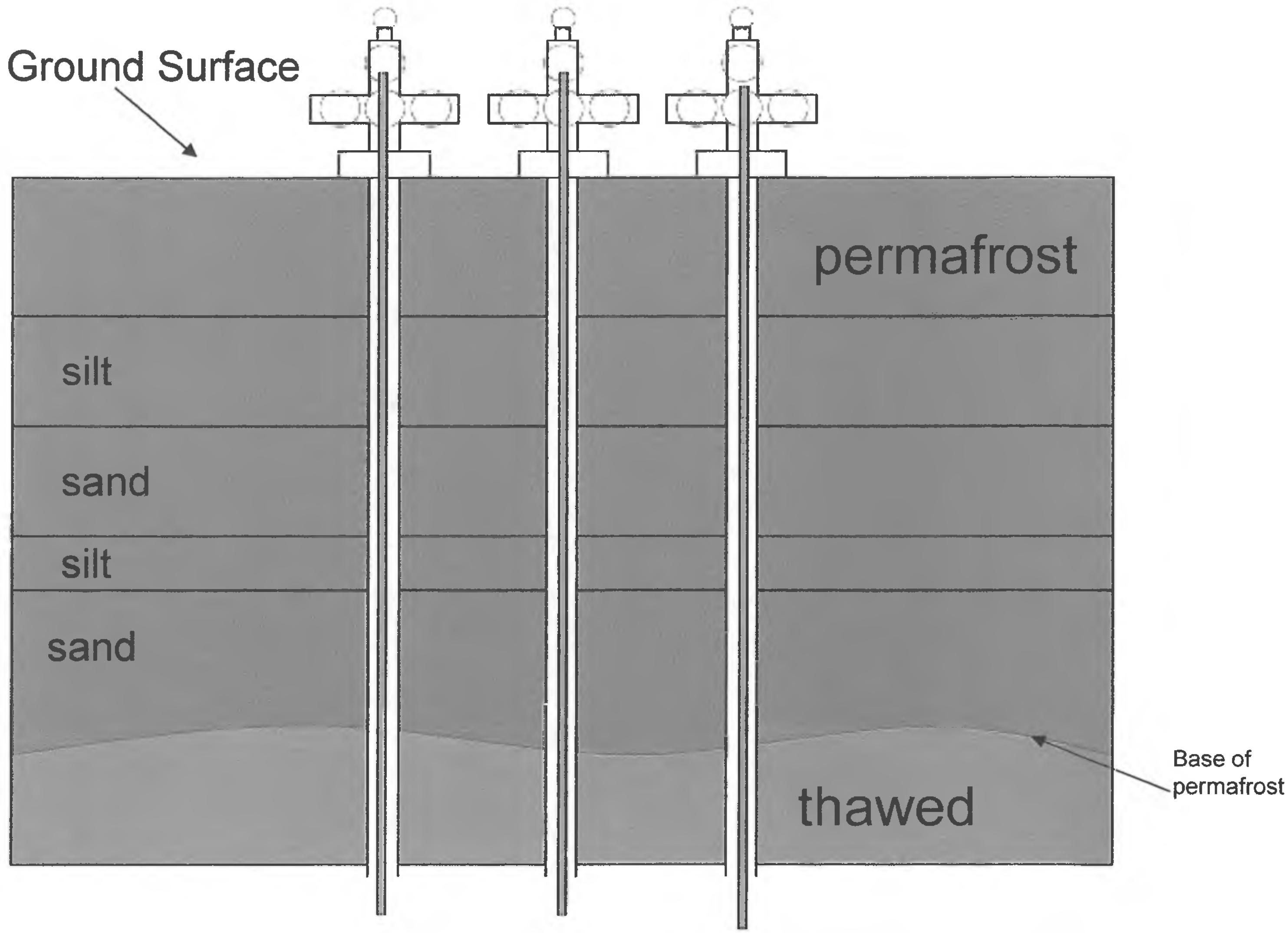


- Heavy oil resource overlies existing fields
- Oil is present in multiple reservoir zones
- **Total: 24 – 33 Bbbls Oil in Place**
  - Schrader Bluff / West Sak – ~12 Bbbls (14-22 API)
  - Ugnu – 12-18 Bbbls (8-14 API)

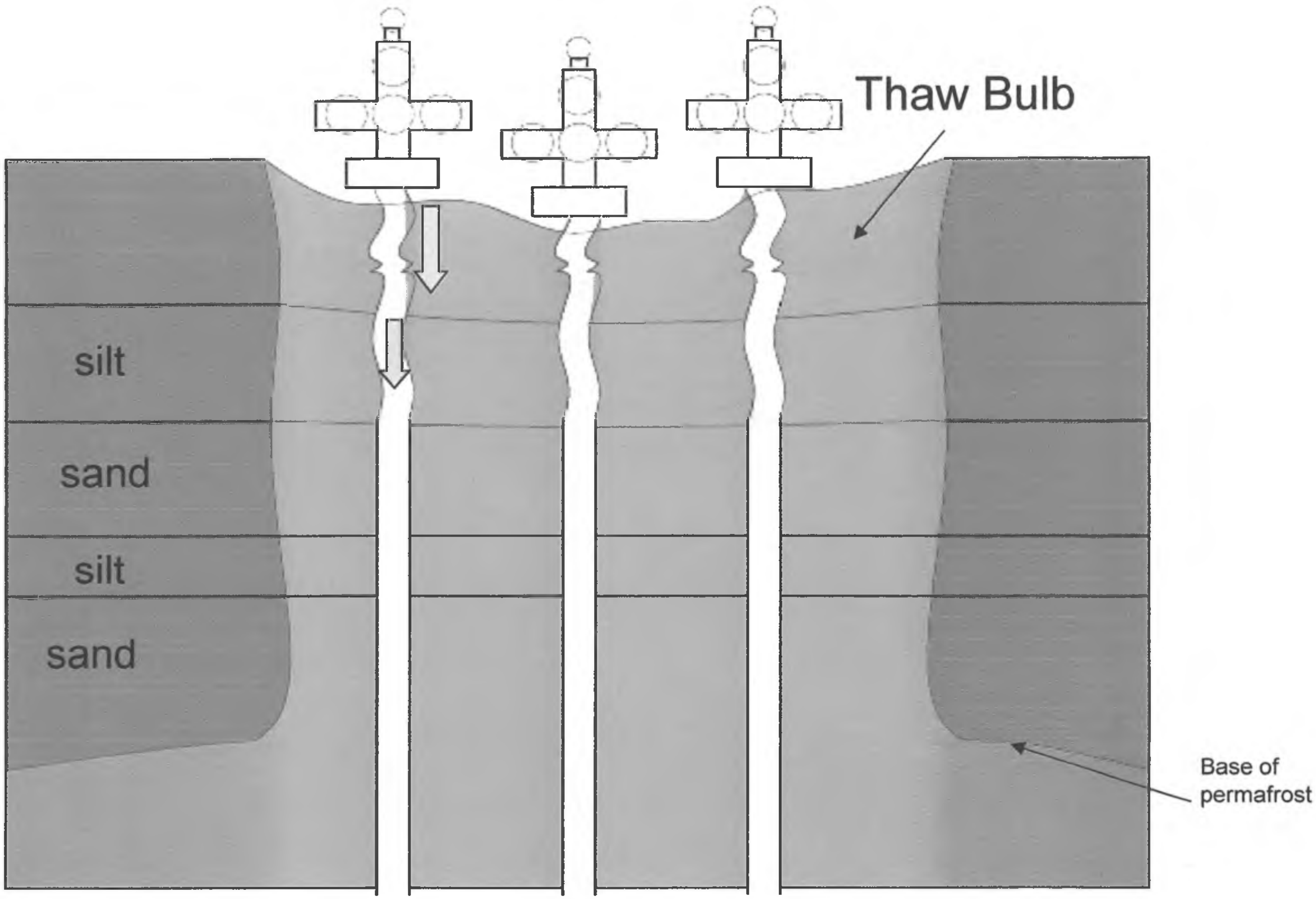


Source: BP Exploration Alaska, 2011. www.aoga.org

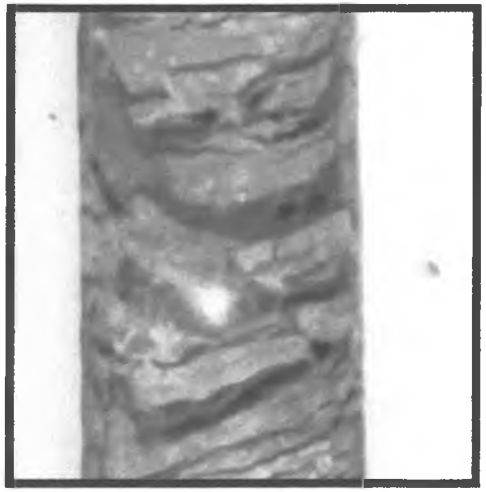
Permafrost Thaw and Subsidence



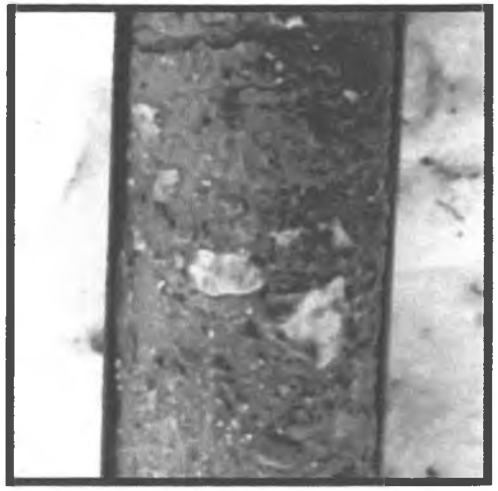
Permafrost Thaw and Subsidence



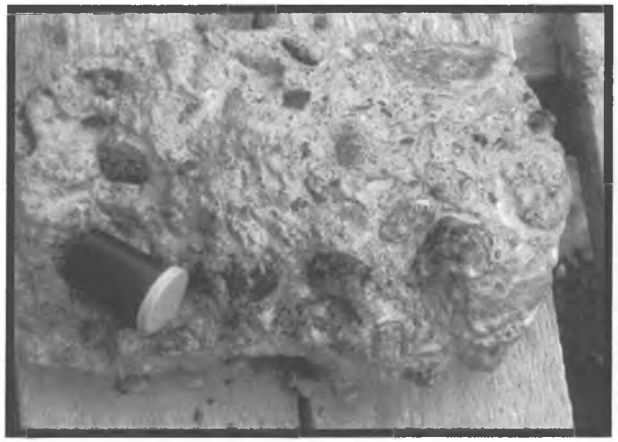
Ice Content Upper Permafrost Soils



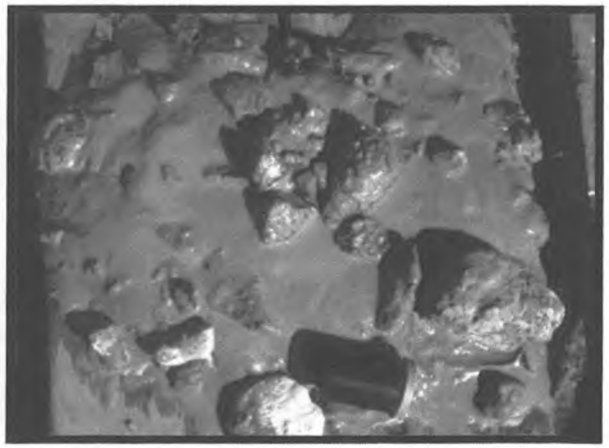
Ice rich frozen silt



Ice poor frozen till



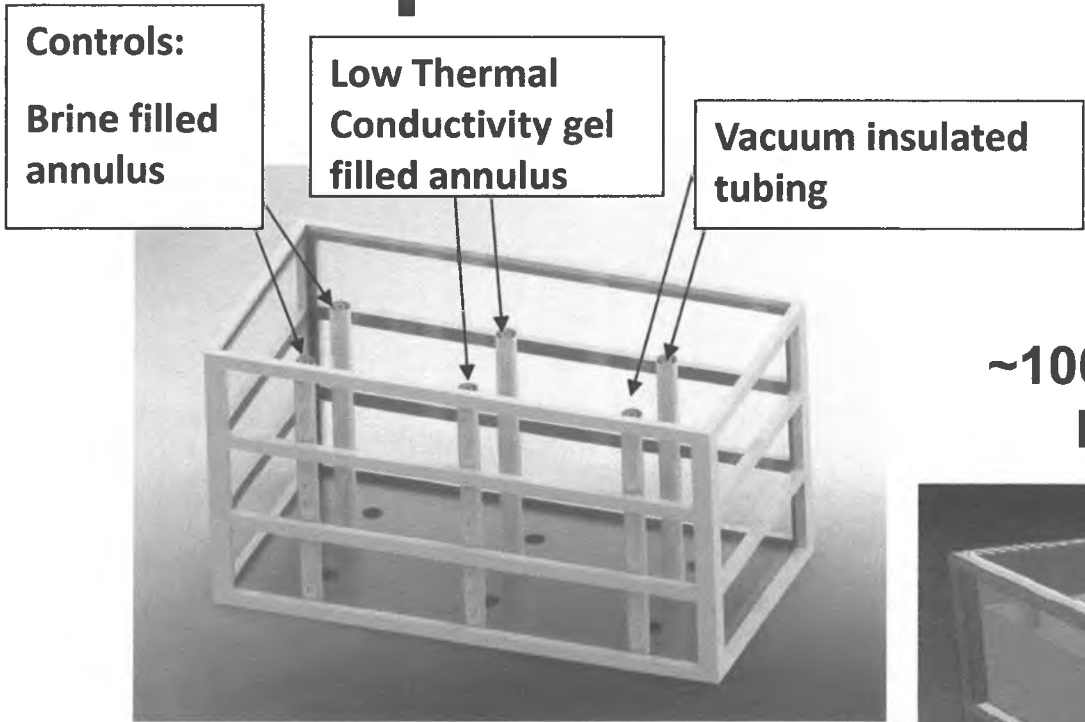
Frozen gravelly silty sand till



Thawed gravelly silty sand till

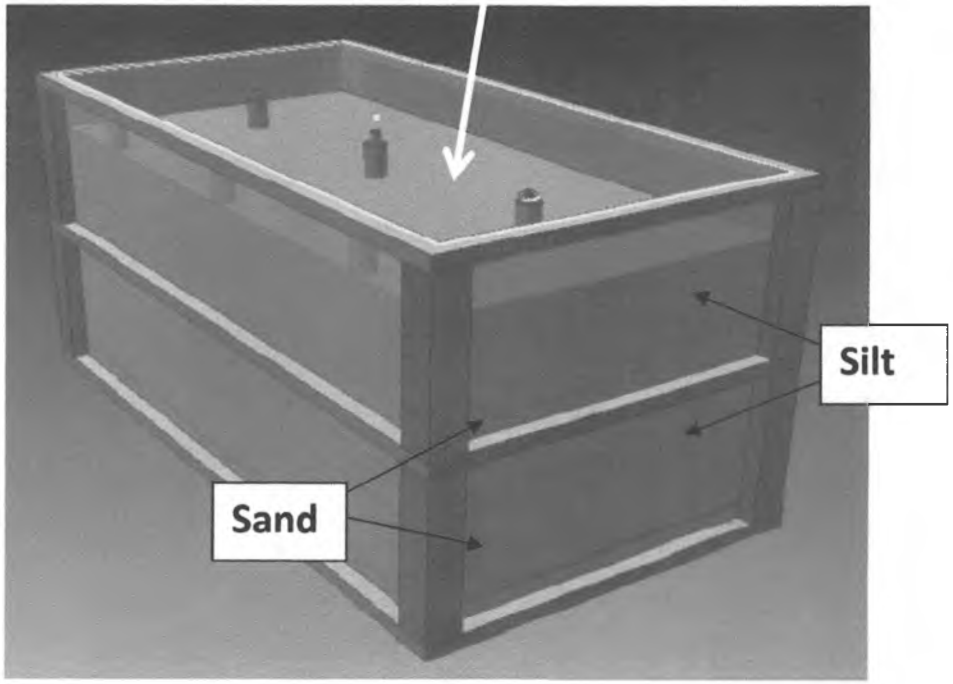
Source: I. Holubec Consulting

Experimental Equipment

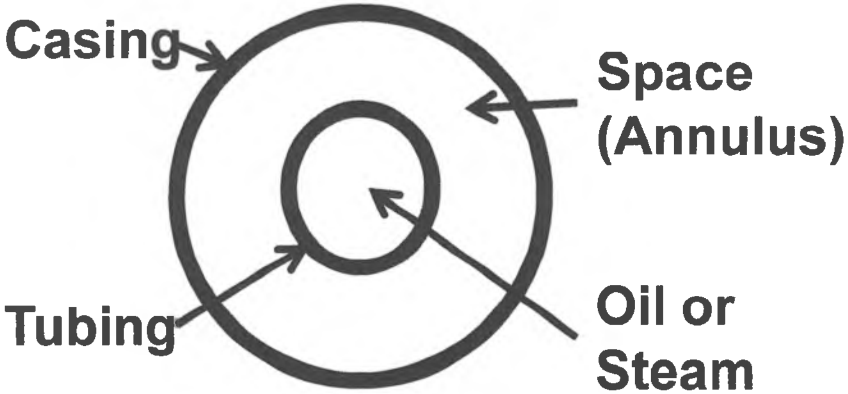


Data Collection

~100 thermistors (heat sensors)
IR thermal image camera



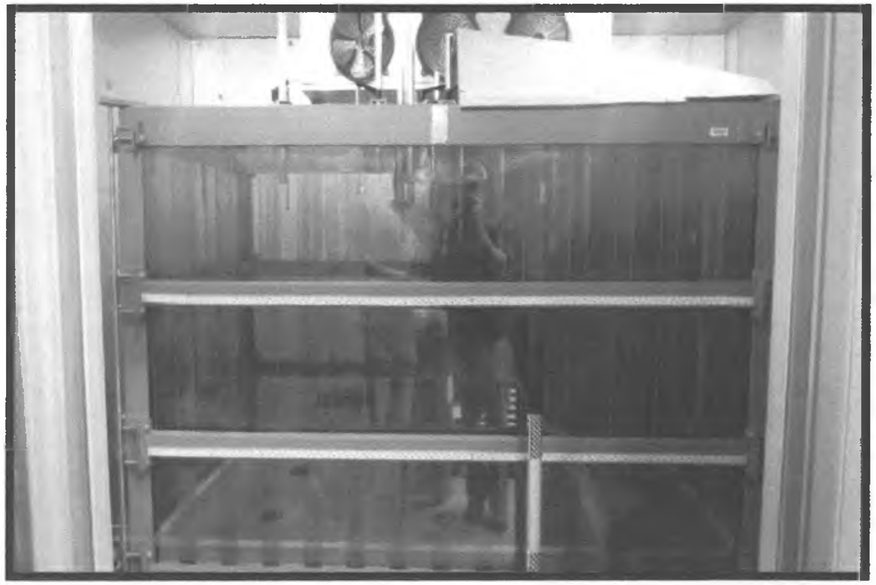
Looking Top-Down

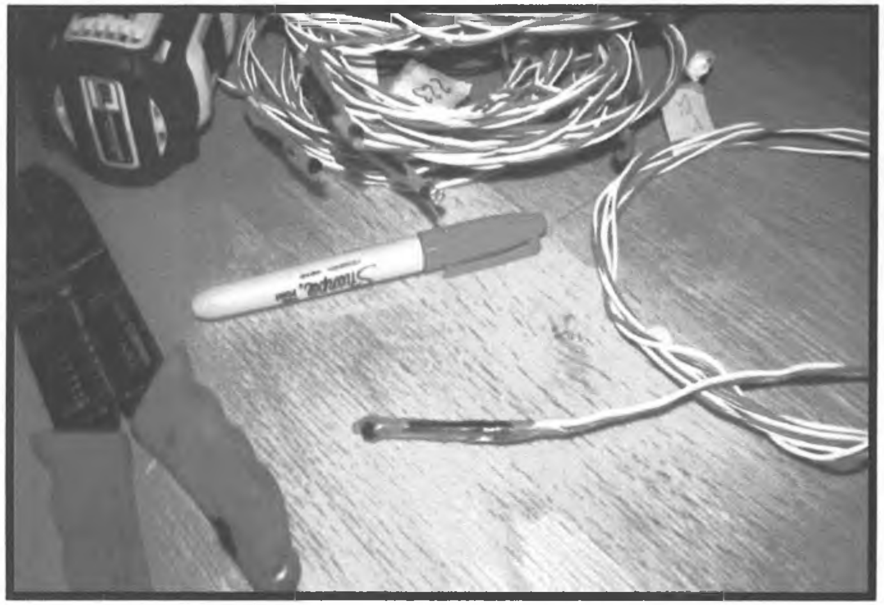


Project Objectives

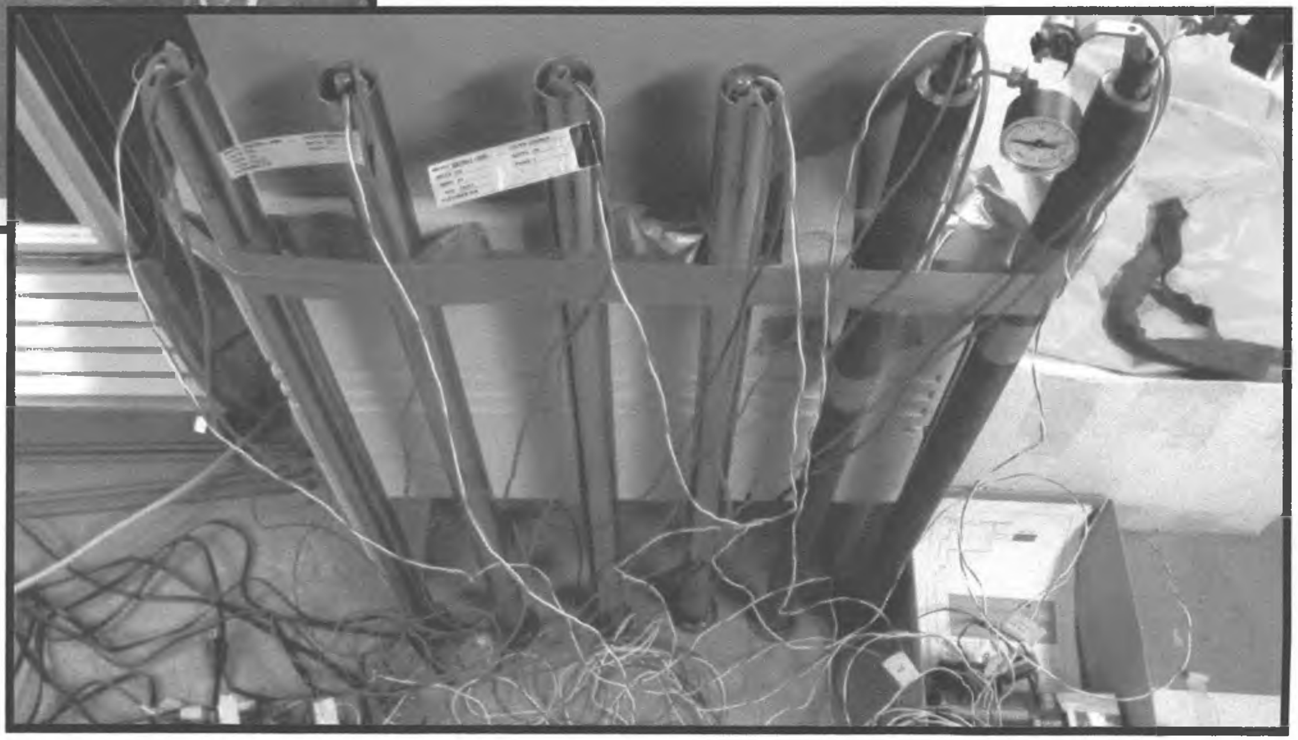
- Collect data to analyze how best to protect current and future wells
- Acquire empirical data for tuning permafrost thaw computer simulations
- Gain lessons learned for future research using frost cell equipment

Project's Current Progress





Project’s Current Progress



Impacts on Future Alaska North Slope Oil Production

1. Estimated 24 – 33 billion barrels of heavy oil, much of it is inaccessible without thermal EOR

2. One step closer to unlocking access to heavy oil on Alaska's North Slope

Future Work

1. More complex/multilayered models. UAF is the first to do this type of physical modeling.

2. Further research into geomechanical forces on scaled down wells

3. Collaboration with Alaska's energy industry

Oil & Gas Related R&D at UAF
Synergies, Partnerships (University, State Govt., Federal Govt., and Industry)

- Phase Behavior, Asphaltene Precipitation- Viscous/ Heavy Oil
- Chemical Flooding and Conventional EOR
- Wettability and Improved Oil Recovery
- Chemical & Microbial Characterization- Viscous Oil
- Methane Hydrates
- CBM- Rural Energy Applications- Ft. Yukon
- Novel Ceramicrete Technology for the Arctic
- Carbon Sequestration
- GTL Transportation

NETL-US DOE

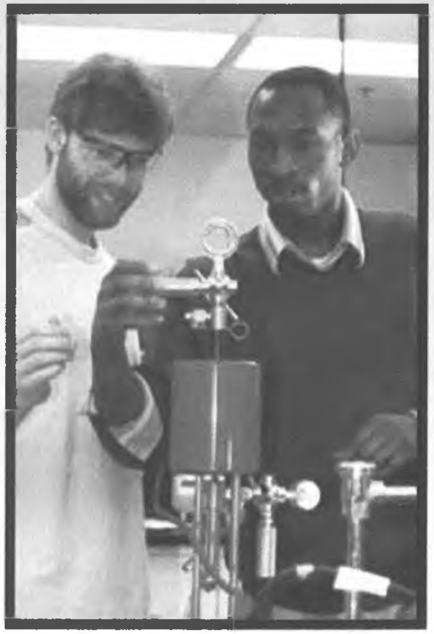
Workforce Development

New Reserves to Declining Production

Economic Development

Student Success

Professional Development- Strong SPE and AADE Sections




KELLY LYONS wants to get the most out of Alaska's oilfields.
The East Coast native didn't take the most direct route to Alaska. For awhile she made sails in Maryland, was a live-in nanny, then drove a flatbed truck. She hit all 48 contiguous states but not Alaska, and since she wanted to go back to school anyway (she has a bachelor of arts degree from St. John's College in Annapolis) she figured she'd check out UAF. "I'm definitely here to stay," she says. "I actually like 50 below." Today she's a senior in petroleum engineering.

"I had no idea I wanted to do engineering, but I thought, well, they have a lot of oil, and I'm good at math and science, so I thought I'd try it." Lyons is president of the UAF chapters of a national engineering honor society and the international Society of Petroleum Engineers, and she's on the advisory and development council for the College of Engineering and Mines.

It's a good thing she's making her home in Alaska, because the state needs her expertise. As an intern with ConocoPhillips, Lyons got hooked by the challenge of enhanced oil recovery. **Now that ConocoPhillips has offered her a job after graduation, she can be added to the list of Alaska's natural resources.**

UAF Petroleum Engineering Student Success

Phillip Tsunemori (B.S.)
1st Place 2004 SPE WRM

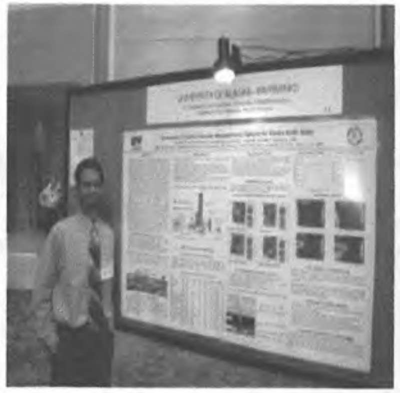
Now with BP Alaska

Namit Jaiswal (M.S.)
3rd Place 2004 SPE WRM

Now with Shell, Houston

Prasad Kerkar (M.S.)
3rd Place 2005 AADE

Now with Shell, Houston



Santosh Patil (M.S.)-
2nd Place 2006 AADE

Now with BP Alaska

Sudiptya Banerjee (M.S.)
1st Place 2005 AADE
3rd Place 2005 SPE WRM

1st Place Sandy Purdy award

Now with Baker Hughes, Houston

Chinedu Agbalaka (M.S.)-
2nd Place 2006 SPE WRM

Now with Chevron, Houston

Praveen Singh (M.S.) (right), 2nd Place
Aditya Deshpande (M.S.) (left), 3rd Place
2008 SPE WRM

Now with BP Alaska & Occidental, CA

UAF Petroleum Engineering Student Success

Petroleum Engineering Alum featured in USA Today

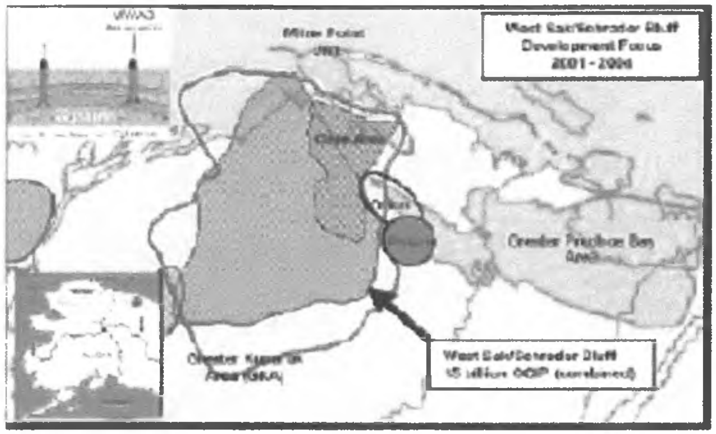
Abhijeet Kulkarni, UAF/CEM Petroleum Engineering alum (MS, class of 2005), now Reservoir Engineer with Shell in Denmark was featured in "USA Today" on February 18, 2013 as New Face of Engineering. Since 2005, Abhijeet has worked numerous assignments for Shell in Netherlands, Middle East and Denmark. He also is the Chairman of the SPE Young Professionals Program, mentoring young petroleum engineers throughout the world. Kulkarni is a reservoir engineer who designs methods to enhance oil and gas production from the North Sea fields. He was nominated by the Society of Petroleum Engineers.

The New Faces of Engineering is a recognition program that focuses on highlighting engineering contributions of young engineers two to five years out of school. These engineers are nominated by Engineers Week sponsoring societies from among their membership.

Partnership for Economic Development

Potential Prize:
25 Billion Barrels
of Viscous Oil

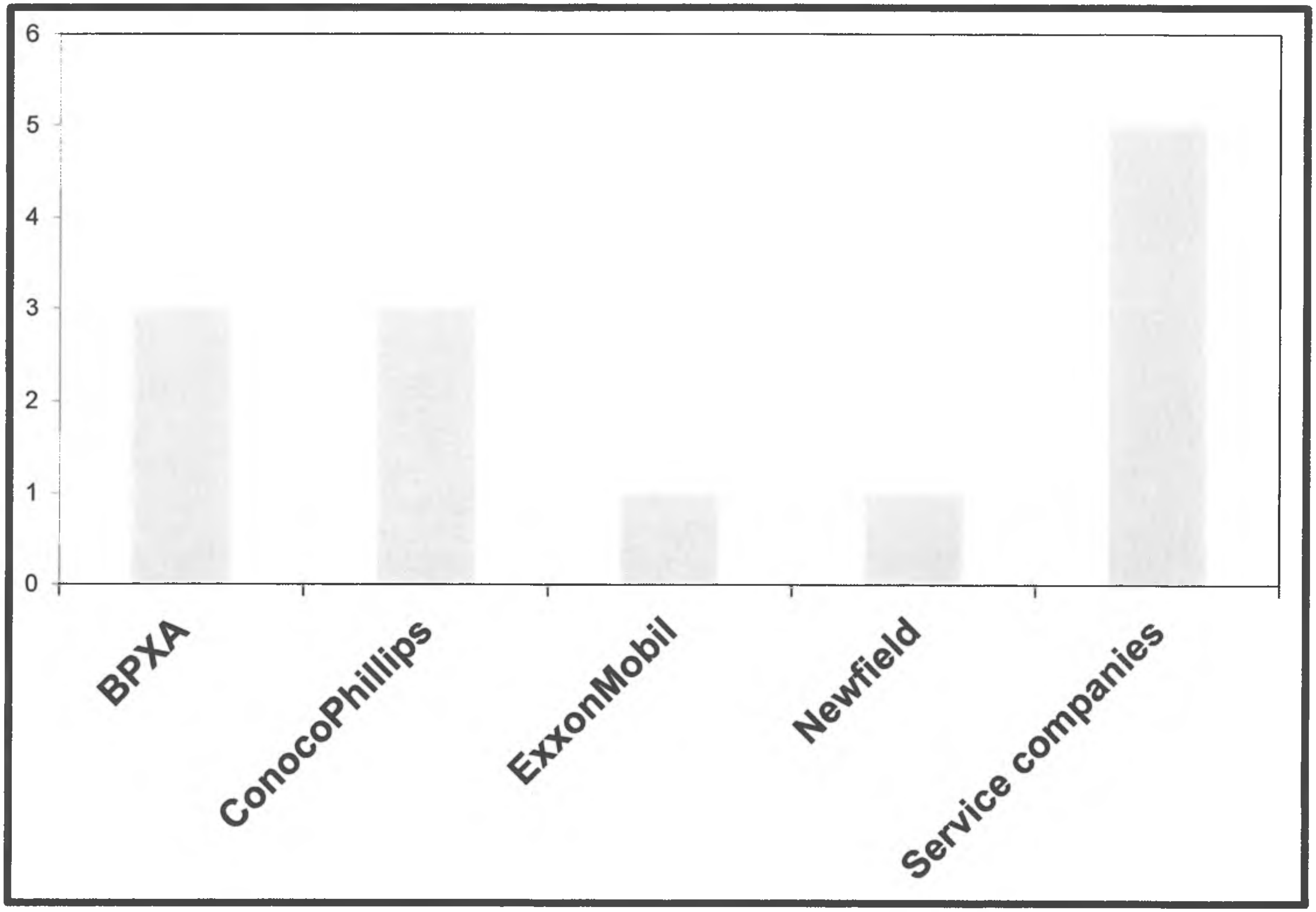
Potential Prize:
100 TCFof NG in
Gas Hydrates



State-of-the-art
Laboratory
Facilities
PDL- UAF

Benefits:
Sustained Resource
Development for
the State of Alaska

2014 Undergraduate Placement Success



Thank you.

www.uaf.edu/ine

Contact:
Shirish Patil, Director
Petroleum Development Laboratory
Institute of Northern Engineering
College of Engineering and Mines
(907) 474-5127
slpatil@alaska.edu

UNIVERSITY OF ALASKA FAIRBANKS

EXTRA SLIDES

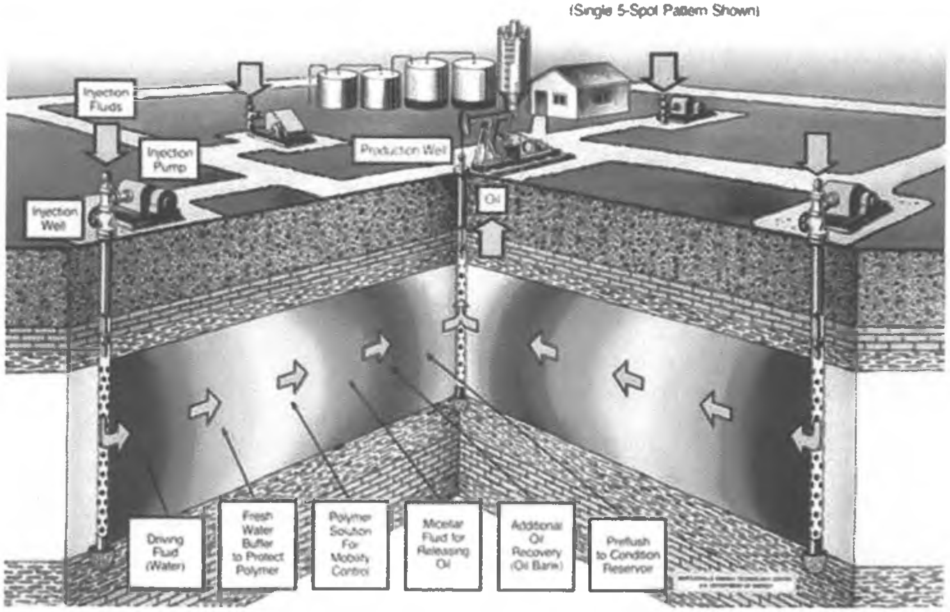
Current Research Projects- PDL

- LowSal™ Water Flooding Studies for ANS Fields
- CO2-MI Phase Behavior Studies
- Reservoir Engineering Studies in Support of Umiat Field Development
- Development of Zeolite Based Cement for HTHP Geothermal Wells
- CO2 Sequestration and CO2 EOR
- Shale Study Project
- Umiat Field Development Study
- EOR For Conventional Oil Recovery

CHEMICAL FLOODING
(Micellar-Polymer)

The method shown requires a preflush to condition the reservoir, the injection of a micellar fluid for releasing oil, followed by a polymer solution for mobility control to minimize channeling, and a driving fluid (water) to move the chemicals and resulting oil bank to production wells.

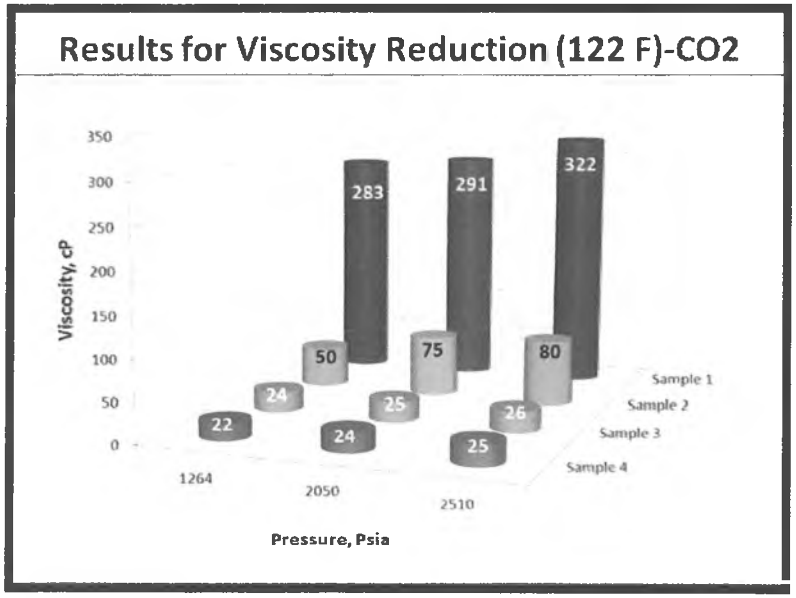
(Single 5-Spot Pattern Shown)

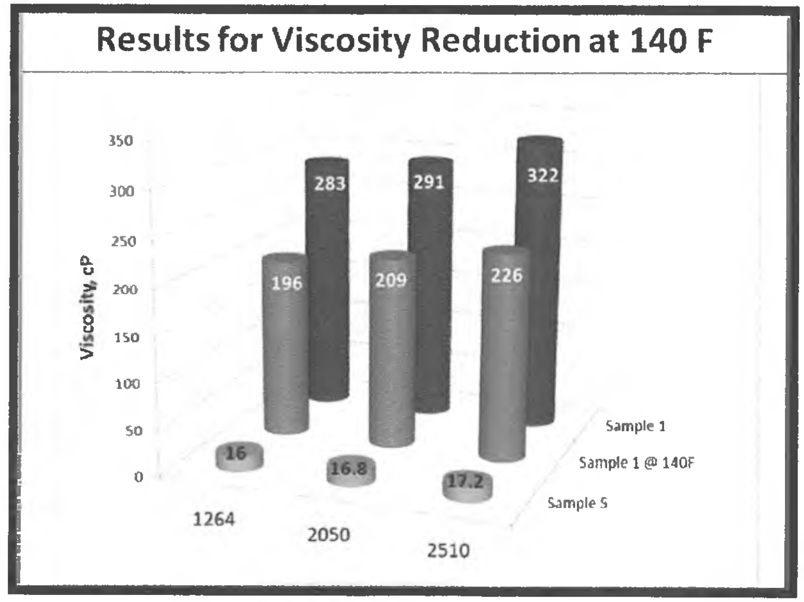


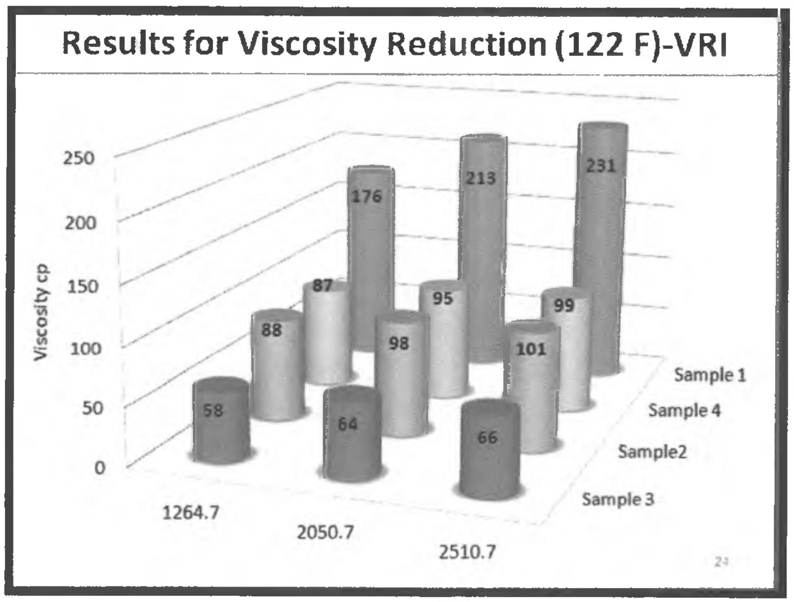
Component	Chemicals	Effect
Alkali	NaOH	Decreases IFT, regulates phase behavior
Surfactant	Anionic/Cationic	Decreases IFT
Polymers	PAM	Controls sweep

- Proven recovery technique worldwide
- Mature fields
- Declining reservoirs
- Permafrost presence doesn't allow thermal recovery methods
- Heavy oil recovery
- Saved injection gas can be used to generate revenue.
- Increase in recovery factor – Simulation results

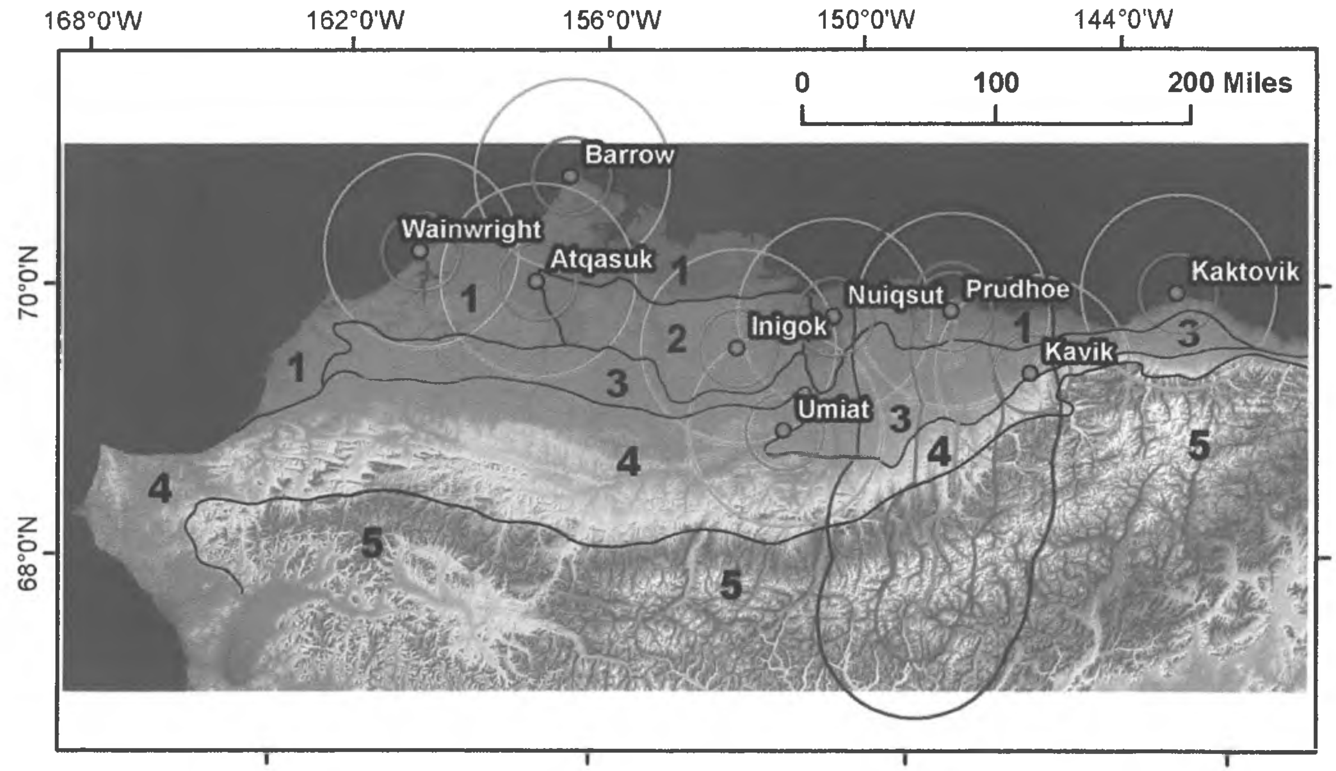
CO2 EOR- Enriched with Nano-Particles







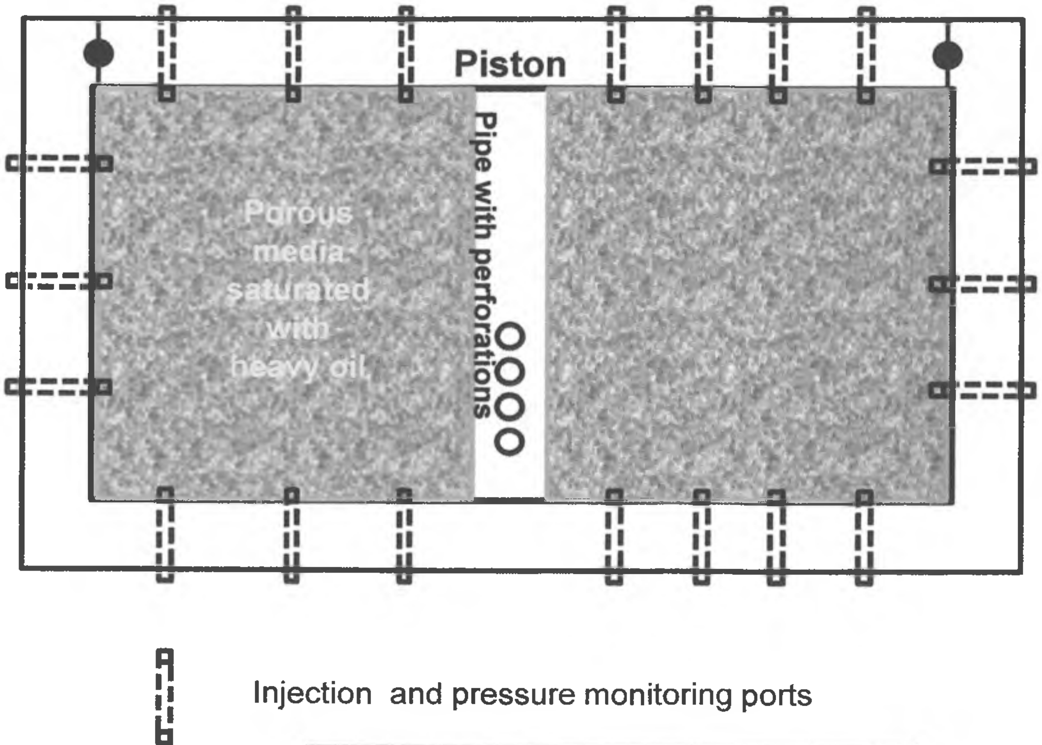
Schematic map of the Northern Alaska permafrost regions



No	Name of the region	Permafrost temperature, °C	Thickness of permafrost, m	Ground ice	Permafrost related hazards
1	Arctic Coastal Plain	–7…–11	200-650	Active ice wedges, pingos	Thermokarst, thermal erosion
2	"Sand Sea"	–5…–8	200-350	Pingos, small active ice wedges	Wind erosion, thermokarst, thermal erosion
3	"Silt belt"	–5…–8	200-550	Huge ice wedges, pingos	Thermal erosion, thermokarst, thaw slumping
4	Arctic Foothills	–5…–7	250-550	Ice wedges	Thermal erosion, slope processes, thermokarst
5	Moderately high mountains	–4…–6	100-300	Buried glacier ice, small ice wedges	Slope processes, thermal erosion

CHOPS Process

- Use an experimental setup to answer the following questions
- What is the effect of reservoir rock and fluid properties on
  - wormhole length,
  - wormhole stability,
  - wormhole pattern?



Injection and pressure monitoring ports

- Is carbonate acidizing a useful analog for the CHOPS process?
- Are concepts like pore volumes to breakthrough useful in this context?

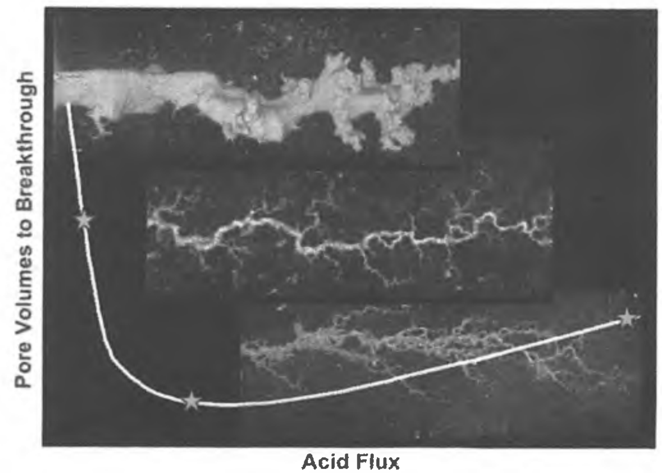
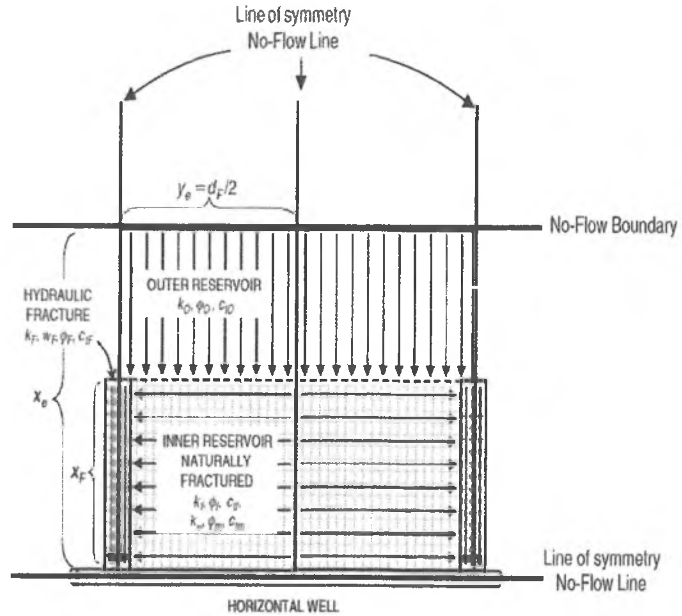


Fig 1—Wormhole-efficiency curve for Indiana limestone with corresponding high-resolution CT images.

Shale Resource Development



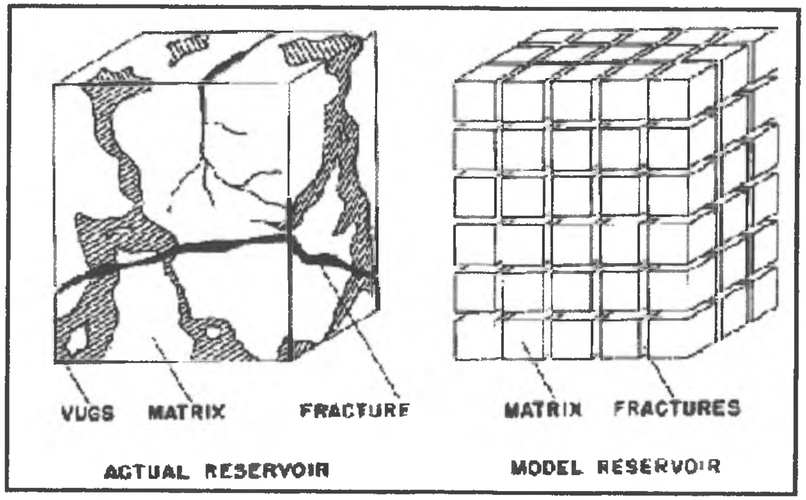
In Depth Understanding of Development Challenges in Unconventional Shale Reservoirs

Objective: Identify the challenges associated with development of Alaska shale resources including leasing and fracturing, as well as expected recovery

This project includes simulation study in two different areas: Hydraulic fracturing and Reservoir simulation.

Focus is on enhancing understanding of shale resources dynamic behavior in order to optimize their development. Both analytical and simulation techniques are used to help ADNR to put in place a successful management plan to facilitate development of these resources:

Thin streaks representing natural fractures



Warren and Root, 1962

UAF Petroleum Engineering Graduates

About The Program

The graduate program in petroleum engineering at the University of Alaska Fairbanks (UAF) offers high quality, contemporary education and research in all areas of petroleum engineering at the M.S. level. A special emphasis is placed on arctic oil and gas development.

The petroleum engineering curriculum is accredited by the Accreditation Board for Engineering and Technology (ABET), the national accrediting agency for engineering programs. Petroleum engineers are in high demand worldwide, and graduates of the UAF program are immediately employable for high-paying positions within Alaska, the rest of the nation and beyond.

Though admission into the graduate programs in Petroleum Engineering is highly competitive, the flexibility in accommodating those with industry experience enables working engineers to take advantage of the opportunity.

A World Of Opportunities

As the only petroleum engineering graduate program in Alaska, students have numerous opportunities available to them at America's arctic university:

- State of the art laboratory equipment
- Excellent computing facilities
- Outstanding faculty
- Small student to professor ratio
- Unique oil and gas research projects
- Great career opportunities

"UAF provided me with excellent career guidance. Upon completing my Masters in Petroleum Engineering I started a new job immediately with an energy company with a large regional office in Alaska. I really enjoy my new career field and I'm very grateful to UAF for being in touch with the job market and pointing me in a great direction with excellent career opportunities."—Mike Timmcke, Petroleum Engineer

Petroleum Development Laboratory

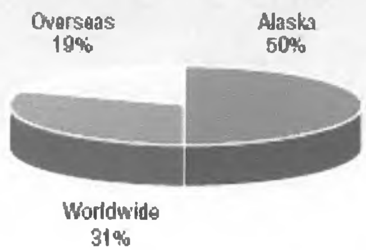
Established in 1984, Petroleum Development Laboratory (PDL) is a state of the art research laboratory conducting energy

related research at the University of Alaska Fairbanks. The primary function of PDL is to explore the various aspects of enhanced oil and gas recovery research. In addition to addressing the unique challenges confronting the petroleum industry, it provides excellent laboratories to supplement petroleum engineering courses. Petroleum engineering students at UAF have access to PDL facilities that match or rival what is being used by industry today. Research conducted at PDL includes basic and advanced studies of oil displacement, reservoir properties of the Alaska fields, thermal recovery, miscible flooding, improved water flooding, gas hydrates, gas-to-liquids (GTL) conversion and transportation, drilling and production. PDL facilities are also supplemented by well equipped reservoir rock and fluid properties, and drilling fluids teaching laboratories. Petroleum engineering graduate students routinely design and develop specialized experimental set-ups for specific research projects.

Career Opportunities

Petroleum engineers earn among the highest starting salaries in the field of engineering. Favorable opportunities are expected for petroleum engineers because the number of job openings is likely to exceed the relatively small number of graduates. Petroleum remains the dominant source of energy, with current world production of oil and gas at record rates. Because oil and gas are an international commodity petroleum engineers have the opportunity to work in the U.S and overseas. UAF graduates are pursued by oil and oilfield service companies in Alaska and worldwide.

UAF Petroleum Program Graduates (BS and MS): Worldwide Employment Distribution



Society of Petroleum Engineers (SPE)

The petroleum engineering department at UAF has a very active SPE student section. The section regularly organizes technical seminars, carries out student mentoring, organizes field trips, and arranges social events. The SPE section also plays an important role in the organization of regional meetings and student paper contests.

American Association of Drilling Engineers (AADE)

The AADE student section is also very active in the professional development of petroleum engineering students. The AADE mission is similar to that of SPE; however, it has a stronger focus on drilling-related issues.

PDL-Established Research Partnerships

NETL

RYDER SCOTT
GEOSCIENTISTS
PETROLEUM ENGINEERS
TECHNICAL ANALYSTS

PRA
Geological, Geophysical, and Reser
Consulting for the Alaska Oil and Ga

bp

ConocoPhillips

BJ

Alyeska pipeline

NATCO

SIGILLUM UNIVERSITATIS ARIZONENSIS 1885

CYNARA

BERKELEY LAB

ASRC Energy Services
a subsidiary of Arctic Slope Regional Corporation

USGS

Anadarko
Petroleum Corporation

U. S. Department of the Interior
Bureau of Land Management

Pacific Northwest National Laboratory

Energy Technology Division
Argonne National Laboratory

Department of Natural Resources
Division of Geological and Geophysical Surveys

UAF
UNIVERSITY OF ALASKA FAIRBANKS

Recent NETL-DOE Funded Oil & Gas Related R&D at UAF
Synergies, Partnerships (University-Federal Govt., State Govt., Industry, Non Profits)

ENERGY SECURITY,
ECONOMIC DEVELOPMENT
ANS Gas Commercialization
IOR, VO/HO, Gas Hydrates,
Coalbed Methane
Pipeline & Transportation
CO_2 EOR and Sequestration

Phase Behavior/ Solid Organic Deposition and EOR Potential of ANS Viscous Oil Reservoirs
UAF-PNNL-BPXA-CPAI
Patil and Dandekar
Funded By AETDL (2005-08)

Chemical and Microbial EOR for Viscous Oil
Patil and Dandekar
UAF-CPA-BPXA
Funded by AETDL
(2006-08)

Alaska Gas Hydrate Project
BPXA, UAF, UAz, USGS
Hunter, Patil, Dandekar,
Funded by NETL (2002-08)

Rural Alaska Coalbed Methane: Application of New Technologies to Explore and Produce Energy
UAF-DGGS(DNR-AK)-GWS
Ogbe, Clough, Patil
Funded by AETDL (2003-06)

Characterization & Alteration of Wettability States of Alaskan Reservoirs To Improve Oil Recovery Efficiency
UAF-PNNL-BPXA
Dandekar, Patil, Khataniar
McGuire, Saripalli
Funded by AETDL (2004-08)

Novel Chemically Bonded Phosphate Ceramic Borehole Sealants for Arctic Environment
UAF-ANL-BJ Services and
Patil, Wagh, Chukwu, Khataniar,
Chen, Dawson
Funded By
AETDL (2004-08)

Resource Characterization And Quantification-Barrow Gas Hydrates
Walsh, Patil, Dandekar
In collaboration with
PRA and NSB
(2006-08)

Carbon Sequestration
UAF-BPXA
Patil, Dandekar,
Clough, McGrail
Funded By
AETDL (2004-06)

Characterization and Development of Alaska Heavy Oil Reservoirs
UAF and BLM (Alaska)
Patil and Dandekar
Funded by BLM
(2005-07)

Fiscal Note

State of Alaska
2014 Legislative Session

Bill Version: SB 168
Fiscal Note Number:
() Publish Date:

Identifier: SB168-UA-SYSBRA-3-27-14
Title: PETROLEUM ENGINEERING RESEARCH PROGRAM
Sponsor: KELLY
Requester: Senate Finance

Department: University of Alaska
Appropriation: University of Alaska
Allocation: Budget Reductions/Additions - Systemwide
OMB Component Number: 1296

Expenditures/Revenues
Note: Amounts do not include inflation unless otherwise noted below. (Thousands of Dollars)

	FY2015 Appropriation Requested	Included in Governor's FY2015 Request	Out-Year Cost Estimates				
OPERATING EXPENDITURES	**FY 2015**	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**
Personal Services							
Travel							
Services							
Commodities							
Capital Outlay							
Grants & Benefits							
Miscellaneous							
Total Operating	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Fund Source (Operating Only)

None							
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Positions

Full-time							
Part-time							
Temporary							

Change in Revenues							

Estimated SUPPLEMENTAL (FY2014) cost: 0.0 *(separate supplemental appropriation required)*
(discuss reasons and fund source(s) in analysis section)

Estimated CAPITAL (FY2015) cost: 0.0 *(separate capital appropriation required)*
(discuss reasons and fund source(s) in analysis section)

ASSOCIATED REGULATIONS
Does the bill direct, or will the bill result in, regulation changes adopted by your agency? No
If yes, by what date are the regulations to be adopted, amended or repealed?

Why this fiscal note differs from previous version:
Revised in Senate Finance to remove $2 million projected capital costs.

Prepared By: Co-Chair Senator Kelly
Senate Finance Committee
Co-Chair Senator Meyer
Senate Finance Committee

Phone: (907)465-3753
Date: 03/27/2014

FISCAL NOTE ANALYSIS

STATE OF ALASKA **BILL NO.** SB168
2014 LEGISLATIVE SESSION

Analysis

This bill creates the petroleum engineering research for hydrocarbon optimization grant program and fund within the University. This fund will need a capital appropriation in order to leverage grants from industry.

Funding through the hydrocarbon optimization bill would allow the University of Alaska to begin addressing aspects of specific concern to the oil industry in Alaska and benefit throughput in the trans-Alaska pipeline system. Of particular interest is heavy and viscous oil, shale oil and gas, and enhanced oil recovery. Conducting research in these areas requires capacity building that could be done with the bill's funding. Funding provided by the hydrocarbon optimization bill would also allow the Institute of Northern Engineering (INE) to organize a fossil fuel integration program. The program would bring together skills from all areas of petroleum related research to ensure that work done at UA has maximum benefit to the industry.

The University of Alaska Fairbanks has a history of working with oil companies in Alaska on oilfield related applied research. Specifically, work in INE has focused on oil production as well as the specific needs of exploration activities such as ice roads and environmental impacts. The hydrocarbon optimization bill specifically speaks to industry involvement in choosing which projects the funding goes towards. This interactive relationship will encourage a productive relationship ensues, one that could increase industry funded research to UA in the future as well as increased oil production to the state. The Petroleum Development Laboratory in INE at UAF is particularly well positioned to advance research in heavy and viscous oil as well as enhanced oil recovery – both areas of need on Alaska's North Slope.

ALASKA STATE LEGISLATURE

Session
Alaska State Capitol 516
Juneau, Alaska 99801
Phone: (907) 465-3709
Fax: (907) 465-4714

Interim
1292 Sadler Way Ste. 308
Fairbanks, Alaska 99701
Phone: (907) 451-4347
Fax: (907) 451-4348

Senator Pete Kelly

Senate District B

Senate Bill 168 – Petroleum Engineering Research Program
Sectional Analysis

Section 1 Amends AS 14.40 by adding a new section: AS 14.40.465 *Petroleum engineering research for hydrocarbon optimization grant program and fund*. This section establishes the fund in the University of Alaska to research engineering practices to increase production of oil and gas from the state's producing fields.

Grants may be made for university research to:

1. Develop technology solutions that address the challenges associated with the extraction of the state's known oil and gas resources
2. Optimization of recovery of oil and gas from existing fields
3. Encourage oil and gas exploration and production in underdeveloped or new areas
4. Protect and extend the useful life of the state's oil and gas infrastructure
5. Educate future generations of Alaskans through research and development opportunities that increase revenue to the state

The UA Board of regents act as trustee of the fund and the President of the University of Alaska may make grants from the fund after consultation with the research advisory committee. The seven-member petroleum engineering research advisory committee is appointed by the President of the University and composed of the following:

1 member from the Governor's office
1 member from the Department of Natural Resources
1 university faculty member
1 member from the Alaska Oil and Gas Conservation Commission (AOGCC)
3 members from the oil and gas exploration and production industry

Recipients must provide an annual report and summary of the research or study conducted under the grant to the president of the university, the legislature, and the AOGCC.

The president of the University may not make a grant from the fund unless the grantee provides at least 20 percent of the proposed grant project in matching funds. This requirement can be waived by the president if matching funds are not available and documents that finding.

Senator.Pete.Kelly@akleg.gov

ALASKA STATE LEGISLATURE

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Senator Pete Kelly
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Senate Bill 168 – Petroleum Engineering Research Program
Sponsor Statement

SB 168 establishes a grant program and fund for hydrocarbon optimization in petroleum engineering research at the University of Alaska through the Institute of Northern Engineering. Recipients of the fund would advance research into petroleum engineering practices to optimize development and production of Alaska's oil and gas resources using the latest recovery methods. Research would be intended to have a direct positive impact on increasing State revenues. Supported research would conduct studies to promote the recovery of technically challenged or unconventional resources including heavy oil, tight formations, and methane hydrates, and would study the application of new technologies to Alaska's oil and gas resources.

The development of Alaska's fossil energy resources is critical to the economic well-being of the State of Alaska. Creating a robust research effort for the best extraction and recovery of these assets through global partnerships between university and petroleum industry researchers would help fulfil our Constitutional mandate to develop our natural resources to their full potential. The fund would ensure that our university graduates are at the forefront of the hydrocarbon extraction technology.

Alaska is an oil producing state. Our State's economy and budget are dependent on not only continuing oil production but increasing it. Other states have turned around declining production through similar programs and SB 168 would have Alaskans actively participating in that effort. This fund would is partially modeled after Texas's STARR program which directs University of Texas researchers to work with producers to ensure access to the best and most current oil and gas recovery methods.

The Alaska North Slope oil field is not only part of our past, but paramount to our future. Alaska has one of the world's largest potential tight-oil and gas formations in the early exploration phase. There are still numerous other untapped resources in Alaska. It is our hope that by finding ways to develop them we can ensure the prosperous longevity of our State.

Please join me in supporting SB 168.

Senator.Pete.Kelly@akleg.gov

Alkali-Surfactant-Polymer (ASP) Flooding: Theoretical and Practical Aspects of CEOR for Alaskan Heavy Oil Reservoirs

Shirish Patil, Director
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Enhanced oil recovery is essential to recover bypassed oil and to improve recovery factor. Alkaline surfactant polymer flooding is a Chemical EOR (CEOR) method which can be used for recovering heavy oil containing organic acids from sandstone formations. It involves injection of alkali to generate in situ surfactants, surfactants to reduce IFT between displacing and displaced phase and polymer to improve mobility ratio and thus sweep efficiency, and is followed by extended waterflood. Concentration of alkali, surfactant and polymers used in the process depends upon oil type, salinity of the solution, pressure, temperature and injection water quality.

Petroleum Development Laboratory (PDL) plans to undertake studies to evaluate and understand CEOR and its effect on recovery, determination of Critical Micelle Concentration (CMC), optimal salinity, concentration of alkali, surfactant and polymer for heavy oil reservoirs on ANS. Also, effects of waterflooding and improvement with ASP flooding will be monitored and compared. Effect of infill drilling, altering chemical combination on recovery will also be evaluated.

Study of these effects on oil recovery will be analyzed theoretically by conducting literature survey and studying Society of Petroleum Engineers (SPE) publications and practically with Computer Modeling Group (CMG) simulator tuned for Alaskan reservoirs. CMG model will be prepared with Alaskan reservoir properties and 5 spot well pattern using STARS simulator. Runs for different chemical combinations with varying ASP concentrations will be carried out during simulation to analyze the effect on recovery. If proved, effective, use of these chemicals for Alaskan reservoirs to increase recovery factor can help to replace current limited supply of miscible gas injection (MI) to CEOR.

CO2 Injection for Heavy Oil Recovery

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The ANS oil production is declining rapidly from the conventional resources also known as "light oils" over the past few decades. This calls upon further development of unconventional resources. These resources are reservoirs and fields containing heavy oils and tar sands that can be classified by their relatively low API gravity and high viscosities. With a decline in the production rate of conventional resources, it becomes significant to further enhance our understanding of these heavy oil resources and how their properties behave within the reservoir. These heavy oil reservoirs require secondary means of recovery due to the fact their high viscosity restricts the flow with primary recovery methods. Carbon dioxide and Miscible Injectant (MI) gas flooding are the principal secondary recovery methods that are being investigated to produce these heavy oils on the North Slope; however, several problems and challenges have been faced while employing such methods.

However, as stated earlier, despite the many benefits from this large reserve of heavy oils, some of the challenges have been hard to overcome such as difficulties in comprehending and characterizing the Pressure-Volume-Temperature (PVT) data and identifying the phase behavior changes as these solvent gases are injected into the oil. In the latter, the main issue faced is the formation of a second liquid phase as CO2 mole fraction is increased with varying pressures. One of the primary reasons this second liquid phase is difficult to analyze is because no commercially available reservoir simulator is capable of rigorously handling a 3-phase hydrocarbon flow (Wang and Lin, 2003).

The basic objective of this work is to help identify at what reservoir pressure and mole fraction of CO2 this second liquid phase occurs. This will be done by using a PVT cell as CO2 will be injected into the cell along with live heavy oil at a pressure and temperature. Through this process, a pressure-composition (P-X) diagram will be created that will help analyze at what pressure and mole fraction this second liquid phase is occurring. Once this is done, the second objective will be to identify the phase behavior of this same live oil injected with a combination of CO2 and an enriched MI gas to determine at what pressure and mole fraction this second liquid phase will disappear. It is essential in the development of heavy oil recovery to entirely comprehend the fluid properties of the reservoir fluid and how the phase behavior is changing with changing variables such as pressure and amount of injected gas. With such an abundance of heavy oil reserves and the constant decline in conventional production, advancements in analysis of highly viscous heavy oil could enhance the life of ANS reservoirs and thus the Alaska North Slope production.

Experimental Studies in Support of Protecting ANS Wells and Thermal Oil Recovery- Heavy Oil Development

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More than three decades of extraction of oil and gas from Alaska North Slope (ANS) subsurface formation has caused alterations of the surface and subsurface formation. The active layer is the surface layer of soil that thaws in the summer and freezes in the winter. Many researchers have reported observations that the active layer and permafrost are already responding to the Arctic warming. This degradation of permafrost has profound effects on mechanical stability of the ground, the landscape processes and the infrastructure (surface and subsurface facilities).

The recent emphasis on decreasing the footprint using directional drilling from closely spaced wells on the small well pads have contributed to thawing of annular region in the permafrost around a warm production well. In the process of drilling a well or extracting oil, natural gas or formation waters, fluid circulating through the wellbore transfers the heat from warm formations at deeper depths to colder formations near surface. The heat from the warm fluid is conducted radially through the casing, thawing the annular area.

During the early developments on ANS the well spacing was about 160 ft. apart. After decades of production the thawed areas were still relatively unconnected to each other, thus most permafrost remained intact and able to resist subsidence. With the modern designs, some of the wells are drilled on 10 ft. spacing, which is contributing to the fact that the thawed areas around wellbores could potentially be connected to each other, causing non-uniform subsidence.

Three major potential problems that could be result of annual thawing are: 1) Annular path to the surface- The thawed area is more permeable to fluids, thereby providing a possible path outside the casing, connecting it to the surface; 2) Stress on the well casing- The thawed area near wellbore could lead to two sources of stress on the well casing, a) caused by thaw settlement when annular region loses strength and settles against the casing adding vertical drag forces and radial pressures on the well pipe, b) caused by increased radial pressure as ice reforms during freeze back of annular area after drilling or production has stopped; 3) Surface subsidence- when ice-rich permafrost thaws, its volume typically decreases, leading to subsidence of the overlying formation and damage to structures above. If the thawed areas (due to closer well spacing) coalesce, it could cause very destructive differential settlement of well pads.

The subsidence problem affects two major issues on the ANS: 1) Protecting the infrastructure and wells for long-term operations for decades to come; and 2) The billions of barrels of heavy oil deposits, would need this infrastructure as well as potential use of thermal EOR technologies in the future will need better solutions to manage the subsidence challenge.

WHITE PAPER: State of Texas Advanced Oil and Gas Resource Recovery (STARR) Program

Prepared by the Alaska Center for Energy and Power at UAF as a possible model for funding energy research in the State of Alaska

Overview

The State of Texas Advanced Oil and Gas Resource Recovery (STARR) Program is a mechanism for funding applied fossil energy research in Texas. Through the STARR program, the Bureau of Economic Geology (BEG) at the University of Texas at Austin Jackson School of Geosciences receives funds from the State on a bi-annual basis to analyze State Lands and other Texas properties and then advise and assist operators on how to increase current production or discover new production. The State requires Project STARR to be revenue neutral—that is, Project STARR must cause new revenue to flow into the State that equals or exceeds the amount that is appropriated to the program by the Legislature.

Program History and Context

The STARR Program was created by the Texas Legislature in 1995. The driving force behind the program's creation was the decline in production in the decades-long production of oil and gas on state lands. A large volume of the remaining oil and gas was deemed as recoverable through improved scientific understanding and strategic, targeted deployment of advanced recovery technologies. While implementation of advanced oilfield technologies has historically been the purview of major oil and gas companies, by the mid 1990's, many large companies had abandoned development of mature Texas oil and gas fields in favor of more lucrative opportunities elsewhere. This vacuum was filled by small producers and independents, many of whom had little to no advanced research or development capabilities. The Bureau of Economic Geology, funded through the STARR program, has stepped in to fill this needed technical support and assure opportunities for maximizing production of the State of Texas' resources are not missed. Primary activities undertaken by BEG using STARR funding include working with state land operators to 1)Deploy advanced recovery strategies and newly developed technologies on a field-by-field basis to ensure maximum recovery efficiency; 2) Encourage exploration in under-developed areas or new plays; and 3) Exploit unconventional hydrocarbon resources.

Overview of the Bureau of Economic Geology

The BEG existed long before the STARR program was created, and research through STARR is only one of the BEG's activities. Established in 1909, the Bureau of Economic Geology is part of the well-endowed (~$400M) Jackson School of Geosciences at The University of Texas at Austin. Much like ACEP, the BEG runs like a business within the University of Texas system, with the primary goal of producing useful science that people can use right away. In addition, BEG serves as the State Geological Survey of Texas (the role the Division of Geologic and Geophysical Surveys fulfills in Alaska). BEG focuses on research 'at the intersection of energy, the environment, and the economy', and has a staff of approximately 200 scientists, engineers, economists, and graduate students (30 participate in the STARR program) who benefit from state-of-the-art facilities and equipment. Researchers generally do not teach courses and are not tenure track. They receive 1-2 months of base funding, with the remainder coming from external grants and contracts as well as project-based state funding sources such as the STARR program. BEG in its entirety expends about $30M per year on its research programs. Funding sources are roughly divided as 1/3 industry, 1/3 state agencies, 1/3 federal.

Allocation of Funding

Approximately $9.5 M biannually is appropriated directly to the University of Texas at Austin to support continuation of the program. This funding is not part of the base state operating budget, but is an increment that is added based on demonstration of performance. In general, the reported ROI to the state is approximately $15-20 for every dollar invested. Results are published in a bi-annual progress report, and ROI calculated in conjunction with the State of Texas Controller's office using six agreed upon categories of soft and hard metrics. In addition, the progress report includes testimonials from the oil and gas industry partners regarding the value of the research conducted through the program.

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NEWS RELEASE

February 18, 2014

ConocoPhillips Files Permit Applications for New Viscous Oil Development

ANCHORAGE, Alaska – ConocoPhillips Alaska, Inc. recently submitted permit applications to regulatory agencies to advance a viscous oil development targeting the West Sak reservoir in the Kuparuk River Unit. The development, called 1H NEWS (Northeast West Sak), is the third new project initiated by ConocoPhillips since the legislature passed an oil tax reform bill, the More Alaska Production Act, last spring.

The 1H NEWS project would include a nine-acre extension to the existing Drill Site 1H to support new wells and associated facilities. Project approval is anticipated in late 2014, with construction beginning in 2015. Construction would continue through 2016, with first oil in early 2017. Cost for the project is estimated at $450 million with an estimated peak production of approximately 9,000 barrels of oil per day (gross). The project will provide around 150 jobs during construction.

In 2013, after passage of oil tax reform, the company also announced plans to pursue development of Greater Mooses Tooth #1 in the National Petroleum Reserve-Alaska and Drill Site 2S in the Kuparuk River Unit.

"Combined with 1H NEWS, these three new projects would represent an investment of about $2 billion, significant new production, and jobs for hundreds of workers during construction," said Trond-Erik Johansen, president of ConocoPhillips Alaska. "In addition to our plans for these new projects, we have also added two rigs to the Kuparuk fleet. These rigs are already adding production and providing several hundred new jobs for Alaskans."

ConocoPhillips believes the improved business climate created by tax reform will continue to create jobs for Alaskans and Alaska businesses, add new revenue for the state and add tens of thousands of barrels of new production from the North Slope. The company expects to have more North Slope production-adding investments to announce in the near future.

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About ConocoPhillips Alaska
ConocoPhillips has been leading the search for energy in Alaska for more than 50 years. The company is committed to responsibly developing Alaska's resources, providing economic opportunity for Alaska, operating at the highest safety standards and being good stewards of our communities. For more information, visit www.conocophillipsalaska.com.

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SB 168
S Finance
March 28, 2014
Bio for Presenters: Dr. Shirish Patil, John Cheshire, Thomas Polasek

I am pleased to introduce Director Shirish Patil, and undergraduate students John Cheshire and Thomas Polasek, are with us today to explain the role their engineering research plays in optimizing oil field development.

You are also invited to their presentation for Lunch and Learn today in the Beltz Committee Room next door, where you can learn more about how Alaska can increase oil production.

Dr. Shirish Patil, PhD, is professor of petroleum engineering and the Director of the Petroleum Development Laboratory (PDL) at the University of Alaska Fairbanks (UAF). He holds a Ph.D. in mineral resource engineering; MS degrees in petroleum engineering and engineering management, all from UAF; MS in mechanical engineering from the University of Pittsburgh and a BS in mechanical engineering from the University of Poona, India. He has over 28 years research experience in the areas of Methane Hydrates, PVT/phase behavior, miscible/immiscible displacement, GTL transportation studies, asphaltene deposition studies and economics. He has managed/co-managed several multi-year U.S. Department of Energy, Alaska Science and Technology Foundation (ASTF), co-operative projects with international oil companies and other research grants. He has been PI or Co-PI of over 20 successfully completed projects and has authored or co-authored over 100 technical papers and reports. He was the recipient of the 2005 Alaska Society of Petroleum Engineers; Engineer of the Year and Alaska all Engineering Societies Engineer of the Year and 2006 Society of Petroleum Engineers Western North America Region Service awards. He also received the 2007 University of Alaska Fairbanks Emil Usibelli Distinguished Service award for his service to the university, profession, community, state and the nation. Patil is also a recipient of the 2010 UAF Distinguished Alumnus award and was recognized as the 2012 Society of Petroleum Engineers (SPE) Distinguished Member.

Shirish serves on the FNSB Transportation Commission as well as the FNSB Sister City Commission for one year. Shirish organizes the Namaste India cultural programs on UAF campus as the groups faculty advisor and also has been engaged in raising funds for Fairbanks Heart Walk program for the past 3 years.

a) Shirish'wife Anjali is a 30 year resident of Alaska, has an MS in Science Management, and works for UA K-12 programs;

b) Their son Samir has a BS and MS in Engineering, 28, born and brought up in Fairbanks, works as an engineer for ConocoPhillips in Anchorage; and
c) Their daughter Mitali has a BS and MS in Biology and BioChemistry, 25, born and brought up in Fairbanks is completing her PhD in Bio-Medical Engineering at the University of Pittsburgh.

The Patil family together have 8 degrees from UA! The Patil's enjoy Alaska's natural beauties and love camping and traveling throughout the state in summer months.

John Cheshire, Undergraduate Research Assistant, Petroleum Development Laboratory.

John is a senior student in the petroleum engineering department at the University of Alaska Fairbanks. He was born in Columbus, Ohio and grew up outside of Pensacola, Florida. After high school, he enlisted the United States Marine Corps Reserves and served one tour in Iraq. While serving in the reserves, he also completed a degree in International Studies at the University of West Florida. He then worked in Japan for some time before moving to Alaska in 2011. After graduation, John will start work at an integrated oil and gas company with major interests in Alaska's oil fields.

John lives in Fairbanks with his wife, who is also a student, and four-year-old son. In his free time, John enjoys spending time outdoors hiking, fishing, or camping with his family; an annual trip to Valdez for salmon fishing is part of their tradition. His son loves of any kind of car, truck or vehicle, and his wife enjoys photographing the beautiful natural scenes of Alaska.

Thomas Polasek, Undergraduate Research Assistants, Petroleum Development Laboratory.

Tom was born in Texas and grew up in California. He spent 6 years in the Marine Corps Reserves while helping his brother start a contracting business. Tom worked as a firefighter in the US Forest Service prior to returning to school at UAF to pursue a degree in Petroleum engineering.

Tom moved from California to Alaska in 2011 to pursue an undergraduate degree in petroleum engineering from the University of Alaska Fairbanks.

For the past two summers he has interned with a major
Alaskan oil company in Anchorage. During his free time, Tom and his wife enjoy being outside doing activities such as rock climbing, hiking, mountain biking, skiing, hunting and fishing."

Upon graduation in May 2014 he will stay in Alaska and begin working in the Alaskan petroleum industry based out of Anchorage. Tom is the student project leader for the Permafrost Subsidence Senior Design Project with the Petroleum Engineering department at the University of Alaska Fairbanks.