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Prudhoe Oil Pool Major Gas Sales Presentation to the AOGCC by BPXA as an individual Prudhoe Bay Unit working interest owner

27 August 2015

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Objectives

- General overview of the Alaska LNG project
- Support Rule 9 Application for amendment of CO 341D Rule 9 for the Prudhoe Oil Pool (POP)
  - Technical justification for increasing the maximum allowable gas offtake from 2.7 to 4.1 BCFD
  - Address several topics of interest for the AOGCC
- Support Application for AIO Modification of AIO 3A and AIO 4F
  - Technical justification for request to inject CO2-byproduct into the POP for Enhanced Recovery and Pressure Maintenance

Alaska LNG

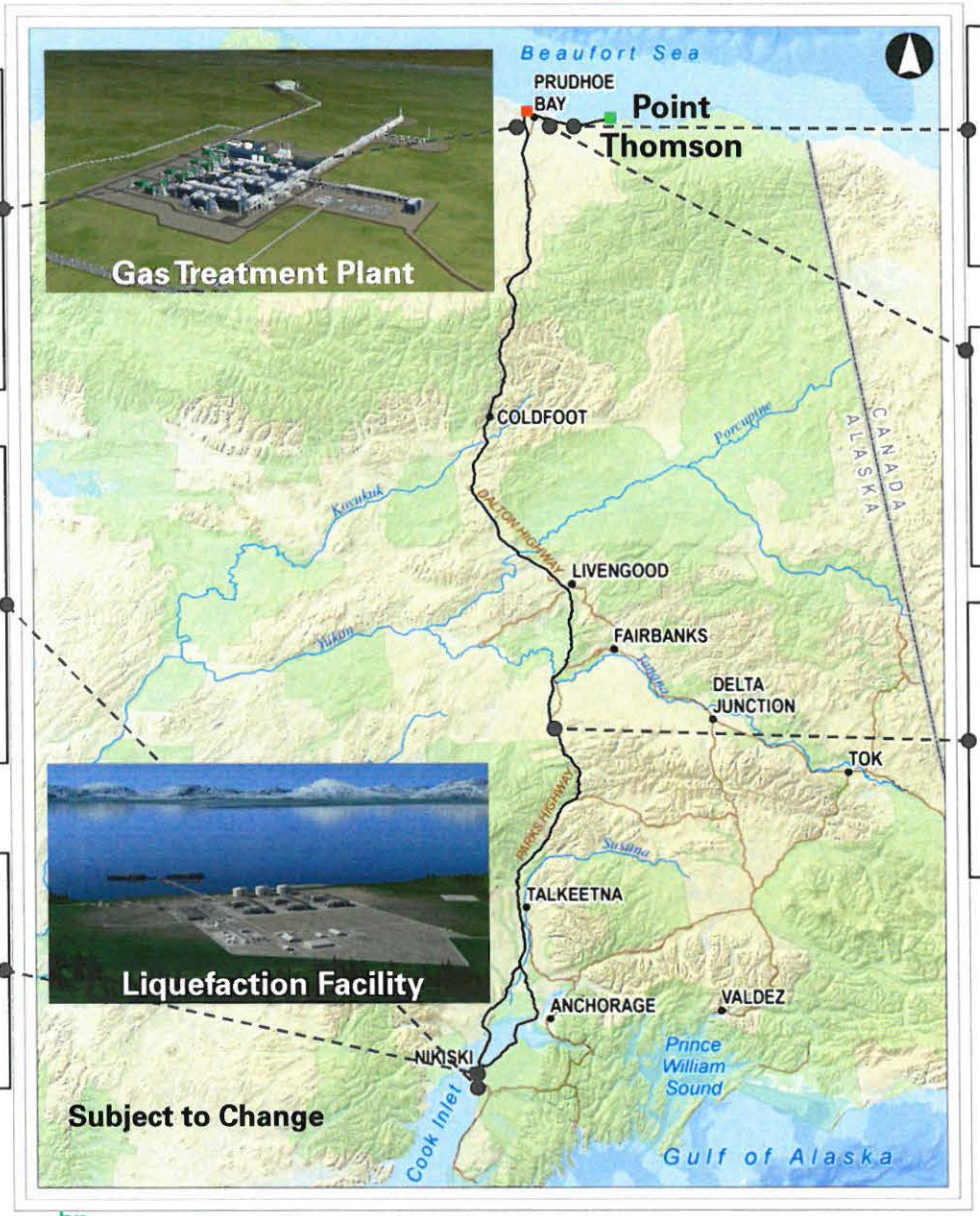
An integrated liquefied natural gas export project that would provide access to gas for Alaskans

Source: AK LNG

Gas Treatment Plant (GTP)
- 3.3 BSCFD peak export rate
- Three trains
- CO2 removed for injection at PBU

Liquefaction Facility
- Natural gas is cooled to -260 deg F
- 3 trains dehydrate, and liquefy gas to produce up to 20 million tons of LNG each year

LNG Storage & Marine Terminal
- LNG storage tanks
- Two jetties for LNG carriers



Point Thomson Transmission Line (PTTL)
- ~60 miles, 32" diameter above ground

Prudhoe Bay Transmission Line (PBTL)
- ~1 mile, 60" diameter above ground

Gas Pipeline
- 800+ mile 42" diameter below ground gas pipeline
- 6-10 compressor stations
- Up to 5 in-state off-take points

Artists renditions of LNG and GTP

ALASKA GASLINE DEVELOPMENT CORP · bp · ConocoPhillips · ExxonMobil · TransCanada

Summary Conclusions

- The Major Gas Sales (MGS) Reference Case (3.3 BSCFD) and the Maximum Allowable Gas (MAG) Sensitivity Case (4.1 BSCFD) both demonstrate significant additional hydrocarbon recovery from POP as a result of major gas sales
- Results of the MGS reference case demonstrate that POP is capable of delivering:
  - Approximately 22 Trillion Standard Cubic Feet (TSCF) of hydrocarbon sales gas or 3.8 billion Barrels of Oil Equivalent (BOE)
  - A gas sales plateau length of 20+ years
  - Continued oil development and production
- The MAG sensitivity case produces an equivalent ultimate hydrocarbon recovery of between 17.7 and 17.8 billion BOE's
- An increase in Rule 9 gas offtake to an annual average of 4.1 billion standard cubic feet per day (BSCFD) is consistent with good oil field engineering practices, and positions the Prudhoe Bay Unit working interest owners to access the MGS opportunity afforded by the Alaska LNG Project, and therefore should be approved

POP Gas Offtake Volume Basis

- Alaska LNG Project has advised gas supply to the GTP must be maintained during normal operations at a rate of ~3.5 BSCFD annual average untreated gas
- GTP feed rate of ~3.5 BSCFD rate allows for 0.4 - 0.5 BSCFD for in-State gas demand and ~2.7 BSCFD to satisfy LNG facility inlet demand
- POP's total gas offtake would also include lease fuel, minor North Slope sales and Miscible Injectant (MI) used outside of the POP in Prudhoe Bay Unit satellites.
- 4.1 BSCFD allows POP flexibility - to supply the full GTP feed rate in the event of supply disruptions from other fields to accommodate improved facility performance and allow operational flexibility

Gas Offtake Requirements		
	POP Offtake – MGS Reference Case (Normal Operations)	POP Offtake – MAG Sensitivity Case
PBU supply to AK LNG	~2.7	~3.6*
PBU lease fuel	~ 0.4	~0.3
Minor North Slope sales (Alyeska, Norgasco , KRU, etc.)	~ 0.2	~0.2
Total	~3.3	~4.1
(all rates in units BSCFD annual average raw gas)		

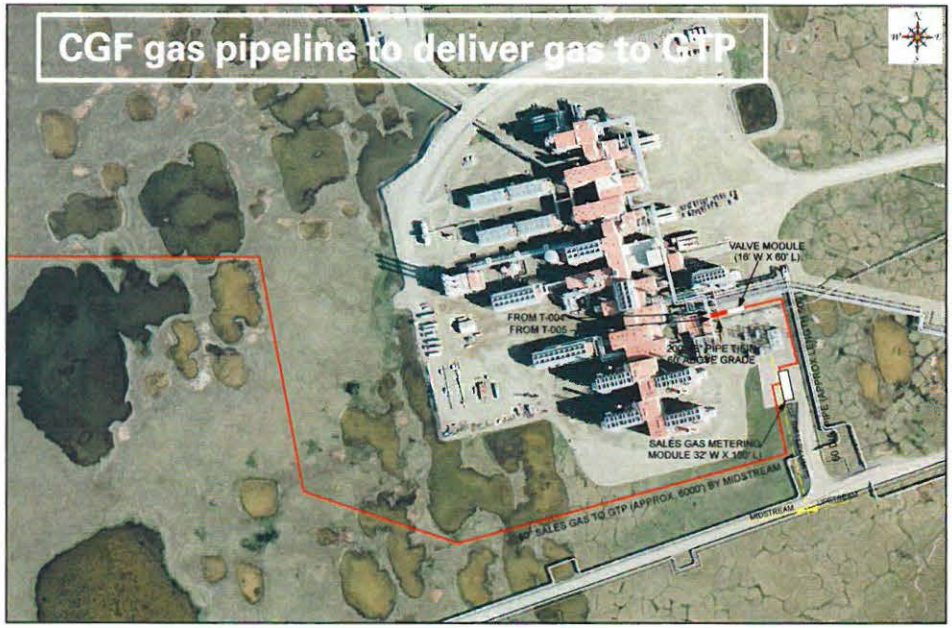
* Higher supply rate due to higher CO_2 concentrations in POP than in other fields

Modeled Gas Offtake and CO2 Handling

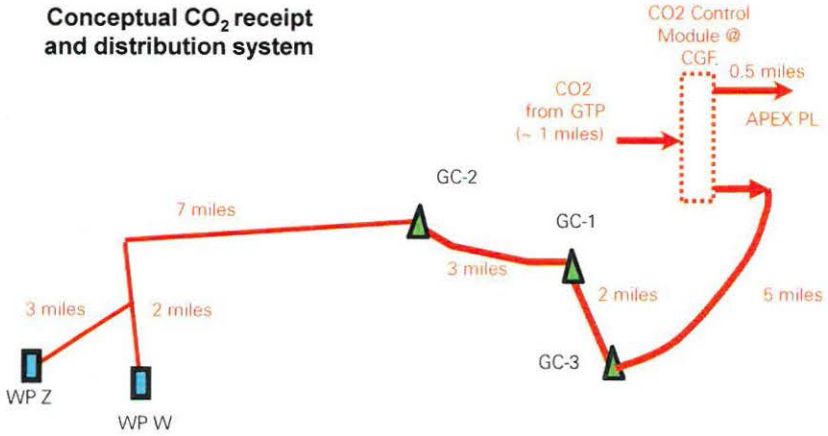
Gas Offtake

- Produce gas from existing well stock
- Optimize offtake with:
  - Targeted re-completion for gas
  - Injector to producer conversions
- Two redundant offtake points at Central Gas Facility (CGF)
- Upgrade select equipment to ensure reliable gas delivery

AKLNG Project participants are designing the GTP to return the CO2 byproduct to PBU



Conceptual CO_2 receipt and distribution system



CO2 Receipt and Injection

- Injection into Eileen West End (EWE) through new pipeline to existing wells at well pads W and Z
- EWE is the most promising option. Additional CO2 injection options outside POP will be evaluated for additional enhanced recovery opportunity
- Backup capability could be FS2 and the Apex injectors

Ongoing Depletion Strategy

- The current field activity prepares for MGS:
  - Active drilling program
  - Rig workovers to maintain healthy well stock
  - Continued Gas Cap Water Injection (GCWI)
  - Active non-rig well work programs
  - Waterflood and MI management
- BPXA and the other unit owners will continue to actively manage field optimization of the depletion strategy to enhance field performance into the future

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AIO Objective and Summary

- Objective
  - Requesting modification to AIO 3A and 4F for the POP
  - Explain technical benefits and implications of injection CO2 into POP
- Summary
  - CO2 handling limitations impact CO2 injection development options
  - POP is injecting a similar amount of CO2 under current field operations
  - EWE is the most promising location for CO2 injection within the POP
  - Additional CO2 from outside sources generates negligible changes to POP reservoir outcomes
  - BPXA has studied and anticipates that the PBU working interest owners will continue to evaluate potential locations where CO2 injection may be economically beneficial for enhanced recovery and pressure maintenance

Summary of the Confidential Portion of BPXA's Testimony

- Discussion of the Full Field Model and the quality and uses
- Forward prediction of the Oil Reference Case
- Detailed discussion of comparative cases and assumptions
- Description of gas delivery and CO2 handling
- MGS Reference Case profile
- MAG Sensitivity Case profile
- Expected recovery comparison
- MGS start date sensitivity
- AIO modification
- CO2 studies already conducted
- POP and non-POP CO2 recovery estimates

BPXA Presentation

- All opinions, assessments and analyses (including forward looking or predictions of future activities) in this presentation are those of BP Exploration (Alaska) Inc., in its capacity as an individual working interest owner in the Prudhoe Bay Unit.
- The PBU FFM consists of three parts: (i) historical PBU operational data; (ii) a set of reasoned assumptions about future PBU activities; (items (i) and (ii) are collectively referred to as the "FFM Inputs"); and (iii) a BPXA proprietary and trade secret process consisting of software code and algorithms owned by or licensed to BPXA (the "FFM Tool"). Full Field Model runs (sometimes referred to as cases or scenarios) are generated by inputting the FFM Inputs into the FFM Tool. FFM runs are meant to be predictive of future circumstances or consequences that could occur, depending on the FFM Inputs. Because of the proprietary and trade secret processes that BPXA employs in the use of the FFM Tool, it is not possible to derive the details of PBU operational or technical data (e.g., specific geological data) from FFM runs. BPXA uses the FFM Tool to generate FFM runs for both itself and, upon request, for the PBU working interest owners. All references in this testimony to the FFM (or to PBU FFM) are a reference to FFM Inputs plus the FFM Tool.