

ALBERTA ENERGY AND UTILITIES BOARD
Proceeding No. 1347905

GB 2003-28
Phase 3 Final Proceeding, Bitumen Conservation Requirements

Information Requests
of Nexen Inc. to
Paramount Energy Operating Corp. (PEOC)

NEXEN-PEOC-1

Reference: ID 99-1 Application, Section 5.1 Core and Facies Identification, within:
Corner McMurray C Pool Submission;
Hangingstone McMurray KKK Pool Submission;
Corner McMurray G Pool Submission;
Hangingstone McMurray X Pool Submission.

Preamble: Facies 1 and 2 are labelled “marine sand” and “marine mud”.

The photo caption for Figure 9: Core Photo of Marine Mud reads “Marine Mud: burrowed silty mud, dominantly *Teichichnus* and *Helminthopsis*

In *Ichnological Concepts and Selected Core Studies, Trace Fossil School Course Notes* by Prof. S. G. Pemberton (pages not numbered) and in *Geology of the Athabasca Oil Sands: Field Guide and Overview* (4th Edition) by Michael J. Ranger and Murray K. Gingras, (Copyright 2001, 2003) on page 110, the following statement occurs: “Environmental Consideration: *Teichichnus*...is prevalent in low energy lagoon/bay settings characterized by brackish-water conditions.”

- Request:**
- a) Please provide Paramount’s definition of “marine”. Specifically, elaborate on whether this environment occurs within estuarine bay deposits with brackish water influence, or whether it occurs in a fully offshore position without freshwater influence.
 - b) Please provide depths for each of the core boxes shown in Figure 8.
 - c) Please identify the depths and geological formation represented by the core photograph on the right hand side of Figure 9.
 - d) Please provide an annotated version of Figure 9 to precisely indicate the interpreted *Teichichnus* burrows.
 - e) Please provide references to support the implication that a trace

fossil assemblage characterized by a dominance of *Teichichnus*, and the implied absence of other traces, would be representative of marine conditions.

NEXEN-PEOC-2

Reference: Appendix 5: Core Logging Plots, within:

Corner McMurray C Pool Submission;
Hangingstone McMurray KKK Pool Submission;
Corner McMurray G Pool Submission;
Hangingstone McMurray X Pool Submission.

Preamble: This section includes core logging plots for Wabiskaw-McMurray interval cores from the following wells:

1AA/10-08-81-10W4
1AA/10-11-81-10W4
1AA/07-26-80-10W4
1AA/10-26-81-10W4
9-29-81-9W4
4-15-81-9W4
6-25-81-9W4
6-9-81-9W4
1AA/3-36-80-10W4
8-35-80-10W4
5-24-81-10W4

Within Appendix 5: Core Logging Plots, the 8-35-80-10W4 core logging plot appears to have an interpretation of a “marine mud” in a position that may coincide stratigraphically with the McMurray A1 interval. On the core logging plot for 8-35-80-10W4, the “marine mud” is indicated as being “5cm” thick.

Within ID 99-1 Application: Section 5.1 Core and Facies Identification, Facies #1: “Marine Sand” is described as “prone to erosion by autocyclic or allogenic processes”. Facies 2: “Marine Mud” is also described as “prone to erosion by autocyclic or allogenic processes”.

Request: a) Please indicate the depths at which *Helminthopsis* was observed within the McMurray Formation in all cores referenced within the

Appendix 5: Core Logging Plots

- b) Please define the characteristics seen in the referenced cores that distinguish “marine mud” from “mud plug”, “bayfill mud”, mud layers within inclined heterolithic stratification (HIS) and any other implied “mud” occurrences.
- c) Please elaborate on the expected preservation potential over a region of influence of a 5cm mud within a deposit that is “prone to erosion”.
- d) Please explain how the presence of a 5cm mud can be inferred from logs in uncored wells.

NEXEN-PEOC-3

Reference: Section 5.2 Facies Determination from Logs, and Figure 1: Base Map of Pool and Wells, within ID 99-1 Application Section in:

Corner McMurray C Pool Submission (pages 11 and 26 of 81);

Hangingstone McMurray KKK Pool Submission (pages 9 and 21 of 69);

Corner McMurray G Pool Submission (pages 10 and 25 of 82);

Hangingstone McMurray X Pool Submission (pages 11 and 27 of 86).

Preamble: In Section 5.2: Facies Determination from Logs, it is stated:

“In potential SAGD project areas reservoir modelling is normally performed in the late exploration stage of a potential production site using closely spaced cores as the control for determining reservoir facies. In this study area only 10 cores are available as the entire area has only undergone moderate exploration for potential bitumen production.”

In Section 9: Summary, it is stated:

“It is unlikely that the bitumen as currently delineated by drilling is exploitable by current or reasonably foreseeable technology.”

- Request:**
- a) Please indicate the current per section drilling density in the area shown on Figure 1: Base Map of Pool and Wells for each of the submissions.
 - b) Please indicate the current per section density of Oil Sands Evaluation wells within the area shown in Figure 1.
 - c) If, “In potential SAGD project areas reservoir modelling is normally performed in the late exploration stage of a potential production site using closely spaced cores as the control for determining reservoir”, please explain the relevance of the submitted simulations which are based on “the bitumen as currently delineated”.

NEXEN-PEOC-4

Reference: ID 99-1 Application:
Corner McMurray C Pool Submission (Page 64 of 81);
Also: Hangingstone McMurray KKK Pool Submission;
Corner McMurray G Pool Submission;
Hangingstone McMurray X Pool Submission .

Preamble: The reference states: “Operating programs for SAGD projects account for anomalously pressured strata by reducing and/or balancing the steam chamber pressure. OPTI Canada’s Long Lake application describes a hybrid operating program where bitumen recovery was conserved by carefully managing operating pressure.”

Request: (a) Please explain Paramount’s interpretation of the “hybrid operating system” and how it was applied in the simulations.

NEXEN-PEOC-5

Reference: Appendix 8: Geological Modelling Report, within:
Corner McMurray C Pool Submission;
Hangingstone McMurray KKK Pool Submission;
Corner McMurray G Pool Submission;
Hangingstone McMurray X Pool Submission.

- Request:**
- a) For each Geological Modelling Report, please list the wells which were used to generate the geocellular model(s).
 - b) Please provide the entire Petrel input data files to the geocellular models.
 - c) Please provide the entire input data files for all of the STARS simulations.
 - d) Please indicate the length of the SAGD wells within the 2-D models.
 - e) Please explain how the bitumen production rate of the SAGD would differ if the following Corner wells were used as the basis for the geological model, instead of those chosen:

10015-3-80-10W4
100/15-3-80-10W4
100/15-10-80-10W4
100/10-13-80-10W4
100/7-14-80-10W4
AA/4-24-80-10W4
100/5-35-80-10W4

NEXEN-PEOC-6

Reference: Review of Hardy Field to Determine the Impact of Wabiskaw McMurray Gas Production

“Differential gas-oil...contacts in high permeability sand would undoubtedly equalize in relatively short times if there was communication.” (Summary, page 1)

“Continuity within a pool also requires similar contacts, especially gas-oil contacts....If there is communication between pools, the contacts would equalize. Simulations could be used to show that the contacts would equalize over geologic time if there is communication.” (Methodology: Geology – G/O contacts, page 27)

- Request:**
- a) Please provide the value of oil viscosity that has been assumed to be present within this study area.

- b) Please elaborate on the process by which such oil or bitumen would have moved over geologic time so as to equalize the gas-oil contacts.