

# Stephen Kar-Kay Wong, P.Eng.

Project Manger  
Epic Consulting Services Ltd.  
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## SUMMARY OF EXPERIENCE

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- Professional Engineer with 24 years of experience.
- Experience with formal technical presentations at conferences, industry technical presentations, software presentations and demonstrations, and client project presentations.
- Experiences include reservoir simulation, CO<sub>2</sub> flooding, waterflooding, thermal recovery, naturally fractured reservoirs, material balance, building geological models and decline analysis.
- Lead authored 3 technical papers based on Analysis and Implications of In-Situ Stress Changes during Steam Stimulation of Cold Lake Oil.
- Master of Science in Mechanical Engineering, June 1981 Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

## EMPLOYMENT HISTORY

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**Engineer/Project Manger** July 2007 – Present  
*Epic Consulting Services Ltd., Calgary*

Responsible for a variety of work related to various reservoir engineering studies; including analytical reservoir analysis and simulation.

**Senior Exploitation Engineer** 2006 – July 2007  
*Dominion Exploration Canada Limited*

Perform all exploitation engineering duties for the Pembina area, including:

- Determine reserves
- Assess proposed drilling locations
- Optimize water flood recovery for the Belly River formation
- Assess potential for secondary and tertiary recovery in the Nisku formation
- Evaluate project economics
- Participate in negotiations with partners and other operators within the area

**Exploitation Engineer** 2004 – 2006  
*Canadian Natural Resources Limited*

- Evaluate acquisition
- Optimize water flood
- Assess potential for miscible flooding
- Design and implement polymer flood pilot
- Develop potential in coal bed methane

**Senior Reservoir Engineer**  
*Calpine Canada Inc.*

2001 - 2004

Perform comprehensive reservoir engineering studies for the following properties:

- Cecil Notikewin gas pool
- Columbia Cardium gas pool
- Columbia Viking gas pool
- Grande Prairie Halfway X pool
- Irricana Wabamun B pool
- Lone Pine Creek Nisku pool
- MarkervillePekisko A pool
- Wilson Creek Pekisko formation

The reservoir studies include detailed review and analysis of:

- geological and petrophysical data
- production and pressure data
- material balance and analytical calculations
- well test data, including both pressure transient and rate transient analyses
- decline analyses and reserve evaluations
- reservoir simulation, with model calibration against field performance and recovery forecast under different exploitation or development scenarios
- results are applied to optimize recovery, choose well locations and book reserves

**Team Leader - Projects**

1999 - 2001

*Epic Consulting Services Ltd.*

Conducted reservoir engineering studies on the following pools:

- Aswad field
- Bonnie Glen D-3A pool
- Carnduff pool
- Caroline field, Viking pool
- Midale Beds pool in southeast Saskatchewan
- Puerto Escondido field
- Sundre Rundle A pool
- Tyvan Red River pool

The reservoir studies consisted of both analytical and simulation work. The analytical work concentrated on surveillance and forecast, while the simulation work focused on calibrating the model to past field performance and predicting recovery under different exploitation or development scenarios. Some studies also included economic analysis.

Additional responsibilities included training of junior staff on reservoir engineering and simulation concepts and the use of a commercial black oil reservoir simulator.

**Project Engineer 1997 - 1999**

*Schlumberger – GeoQuest, Calgary, Alberta*

Conducted reservoir simulation studies on various pools, including:

- Water flooding on the Mantario East pool
- Hanlan Swan Hills gas pool
- Miscible flood of the Joffre D-3B pool

Modeled the VAPEX recovery process for heavy oil using a compositional reservoir simulator.

Provided support to users of the Eclipse suite of software, including the black oil simulator, the thermal reservoir simulator, and the fluid properties software.

**Senior Engineer**

1993 - 1997

*Bharti Engineering Associates Inc., Lively Ontario*

Performed mine designs, i.e. recommended stope dimensions and mine layouts, optimized mining sequences, predicted mine stabilities, and recommended pertinent ground support. This was done through computer modeling using state-of-the-art software, and supplemented by accepted empirical techniques.

Analyzed ground water movement around dams using a three-dimensional finite element flow model.

Involved in the designs and analyses of structures using both analytical and numerical tools. Sample projects included analysis of a failed timber raise, design of portal steel subject to dynamic loads, and design of shaft steelwork and conveyances with consideration of the dynamic behavior of the various components.

**Reservoir Technologist**

1989 - 1993

*BP International Limited, Sunbury Research Centre, Sunbury-On-Thames, Middlesex, England*

Modeled faults and fractures and their effects on flooding operations, focusing on effects arising from geomechanical processes. Results allowed prediction of water breakthrough time and direction and optimization of waterflood operations.

Developed models on inflow performance of horizontal and slanted wells, accounting for effects of well bore friction, drainhole completions and layered reservoirs. These models were implemented in a comprehensive tool for well performance analysis and well completion design used by BP Exploration in the North Sea and elsewhere.

Modeled the invasion of drilling mud filtrate into oil formations under realistic drilling conditions, quantifying the effects on well inflow performance. Findings allowed for the minimization of adverse effects of drilling mud invasion.

Modeled the mixing of oils with different properties over geological time scales in the Gyda field in North Sea, using a special purpose reservoir simulator. Outcomes used to assess the

likelihood of flow barriers between various parts of the reservoir and have implications on reservoir development.

Enhanced a network model to simulate mass and heat transfer in naturally fractured reservoirs. Output provided data for further stress and deformation analysis of fracture reservoirs. Developed user manual and provided training.

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**Reservoir Engineer**

1983 - 1989

*BP Resources Canada Ltd., Calgary, Alberta*

Analyzed stresses and fracturing during cyclic steam simulation of unconsolidated oil sands reservoirs. Results influenced the choice of the operating strategy for the Cold Lake heavy oil project. Also in support of this goal: determined the in-situ stresses; history matched a stress model to the pilot data; and monitored a joint industry R & D project on oil sands fracture modeling.

Performed reservoir studies using a commercial thermal reservoir simulator. Sample studies included production forecasting, operating strategy optimization, project locations, steam additives. Results have direct impact on field operation designs for steam injection, oil production and pattern size and location.

Developed a novel thermal recovery process involving horizontal fracturing for faster and higher

production from oil sands reservoirs.

Maintained and enhanced an economics and planning model. Provided user support for software.

**Research Engineer**

1981 - 1983

*Intercomp Resource Development and Engineering Limited, Calgary, Alberta*

Enhanced and maintained a comprehensive hydraulic fracturing simulator which coupled together a reservoir flow model, a pseudo-three-dimensional fracture model and a proppant transport model. Provided the theoretical basis for hydraulic fracturing modeling as part of an industrial course on hydraulic fracturing.

## **EDUCATION**

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**Master Of Science in Mechanical Engineering** **June 1981**  
Massachusetts Institute of Technology, Cambridge Massachusetts, USA

**Bachelor of Science (Magna Cum Laude) in Mechanical Engineering** **June 1978**  
Brown University, Providence, Rhode Island, USA

**Associate of Science (Highest Honor) in Mechanical Engineering** **December 1975**  
Vincennes University, Vincennes, Indiana, USA

### **Relevant Courses**

Attended graduate courses at the University of Calgary on numerical reservoir simulation and thermal recovery. In addition, took various industrial courses, including reservoir management, log analysis, practical reservoir simulation, hydraulic fracturing, oil sand fracturing, economics and risk analysis, well testing, technical writing, presentation that works.

## **PROFESSIONAL MEMBERSHIPS**

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- Association of Professional Engineers, Geologists and Geophysicists of Alberta
- Society of Petroleum Engineers

## **PUBLICATIONS**

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1. Baker, R.O., Telesford, A., Wong, S., Li, V., Smith, G., and Schoendorfer, H.: "An Integrated Fracture Characterization of a Heavy Oil Naturally Fractured Carbonate Reservoir", paper no. 2001-13, Prepared for Presentation at the CIPC Conference held in Calgary, AB., June 12-14 2001.
2. Heffer, K.J., Koutsabeloulis, N.C. and Wong, S.K.: "Coupled Geomechanical, Thermal and Fluid Flow Modeling as an Aid to Improving Waterflood Sweep Efficiency", Presented at SPE/ISRM Rock Mechanics in Petroleum Engineering Conference, Delft, The Netherlands, 19-31 August, 1994.
3. Settari, A. and Wong, S.K.: "Modeling of Fracture Propagation in Layered Reservoirs", SPE 18958, Presented at SPE Joint Rocky Mountain Regional/Low Permeability Reservoirs Symposium and Exhibition, Denver, Colorado, 6-8 March, 1989.
4. Harding, T.G., Bombardieri, C.C. and Wong, S.K.: "Method for Obtaining Horizontal Fractures in an Oil Reservoir", Canadian Patent No. 1235652, 1988-04-26.
5. Wong, S.K.: "Analysis and Implications of In-Situ Stress changes During Steam Stimulation of Cold Lake Oil Sands", SPE Reservoir Engineering, February 1988.
6. Wong, S.K. and Cleary, M.P.: "Numerical Simulation of Unsteady Fluid Flow and Propagation of a Circular Hydraulic Fracture", Int. J. Num and Anal. Meth. In Geomech., (1985) 9, 1-14.
7. Wong, S.K. and Cleary, M.P.: "Numerical Analysis of Axisymmetric and Other Crack Problems Related to Hydraulic Fracturing", Report No. REL-81-4, MIT Resource Extraction Laboratory, June 1981.