



Well Test Analysis Workshop

Course Objectives:

The objective of the Well Test Analysis Workshop is to provide a comprehensive theoretical and practical knowledge of well test analysis techniques. Emphasis will be placed on the practical aspects of well testing and several class examples will be offered; a scientific hand calculator will be required. Further, the use of the analysis results as a reservoir management tool to make decisions related to reservoir development and well completion will be illustrated through actual case studies throughout the workshop. Recent developments in testing of Multi-stage Frac Horizontal Wells (MFHW) and Mini fracturing are now included. Also, to offer hands-on experience, attendees are encouraged to bring interesting well tests for analysis and discussion in the class, using a commercial software. A detailed course hand-out, which is an excellent reference, will be provided.

Who Should Attend:

This course is aimed at reservoir, petroleum and exploitation engineers/technologists, geophysicists, and geologists who are involved in the field development and exploitation.

Course Instructor:

Mr. Saad Ibrahim, P. Eng, president of Petro Management Group Ltd. with 30 years of diversified experience in the oil and gas industry as a worldwide highly recognized engineering consultant and a distinguished instructor (Please see his professional profile).

Course Agenda:

- **Review of the flow equations:**
 - ▶ Equation of state, Darcy and continuity equation
 - ▶ Common flow geometry
- **Dimensionless parameters:** definitions and Type Curve use/applications
- **Boundary conditions:** infinite, Pseudo- steady state and steady state
- **Solution of the diffusivity equation:** (class problem)
- **Build-up test analysis:**
 - ▶ Principle of Superposition

- ▶ Horner Plot; average reservoir pressure (MBH) method (class problem)
- ▶ Reservoir boundaries and channel analysis
- **Wellbore skin factor and partial penetration** (class problem)
- **Wellbore storage:** use of type curves and (class problem)
- **Draw-down testing:**
 - ▶ Application and test analysis and equivalent time
 - ▶ Reservoir Limit Testing (case example - fracured basement)
- **Hydraulically fractured wells:**
 - ▶ Fracture characterization (frac. Half-length, conductivity and orientation.
 - ▶ Use of type curve techniques and fourth-root time plot to evaluate frac. Efficiency
 - ▶ Mini Fracs; benefits and test interpretations
- **Practical well testing.** How to get the most out of well testing
 - ▶ **Prior to testing** (Well test objectives, types of tests, test design)
 - ▶ **During the test** (monitoring, optimizing test design)
 - ▶ **After the test:** operational problems, data quality (pressure, production and fluids) - several case examples
- **Well test interpretations:**
 - ▶ Flow regime diagnoses using the pressure derivative
 - ▶ Conventional analysis
 - ▶ History matching of pressure data and selection of reservoir models- Case examples
- **Demonstration of pressure recorders** (by: Gord Regehr from Lonkar Services)
- **ERCB well test requirements** (Guide 40)
- **Gas well testing:**
 - ▶ P, P² and Pseudo pressure-time methods
 - ▶ Gas deliverability testing: single point - Multi-point test (class problem)
 - ▶ Simplified and L.I.T. techniques
 - ▶ Unconventional gas testing (CBM, shale gas)
 - ▶ Production analysis techniques; flowing material balance, Blasingame Type Curves, Agrawal normalized rate.

- **Water injectivity tests:**
 - ▶ Step rate and Fall-off tests (case examples)
 - ▶ Hall Plot (class problem #8)

- **Naturally fractured reservoirs. Characterization of the reservoir using:**
 - ▶ Pollard and Pirson Method (class example)
 - ▶ Warren and Root Method (class example)
 - ▶ Bourdet & Kniazeff method

- **Well test planning design**
 - ▶ Test equipment
 - ▶ Flow/Buildup test design (class example)
 - ▶ Isochronal test design (class problem)
 - ▶ Reservoir limit test (case example)
 - ▶ Reservoir boundaries (case problem)
 - ▶ Horizontal well test (case example)

- **Optimization of Multi-stage Frac Horizontal Wells (MFHW); including:**
 - ▶ Well spacing
 - ▶ Spacing and the number of fracs
 - ▶ Benefits of the sweet spots
 - ▶ Case studies

- Review/analyze well tests provided by attendees including several examples using a commercial software

- Closing comments and question period