Water Production Impacts Oil and Gas Wells

•**Water production** is one of the **major** technical, environmental, and economical **problems** associated with oil and gas production

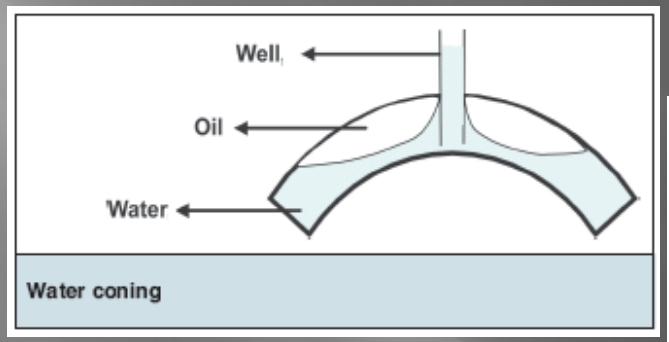
•Water Production results in:
- •more complex water–oil separation
- •fines migration
- •hydrostatic loading
- •Rapid corrosion of tubular and well equipments
- •Rapid decline in hydrocarbon recovery
- •Premature abandonment of the well

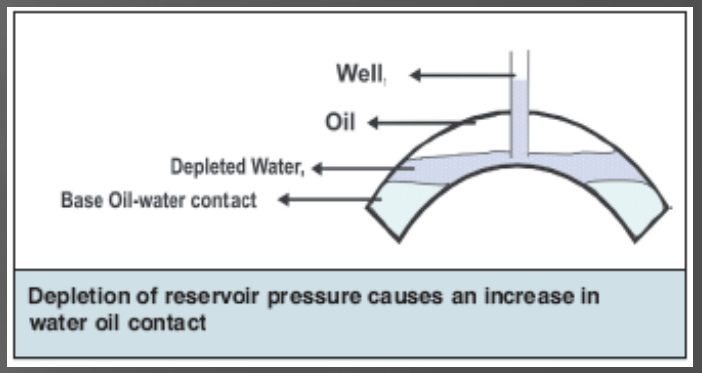
• **Water production limits productive life of the oil and gas wells**

•**Produced water represents the largest waste stream associated with oil and gas production**

Main Sources of Water Production

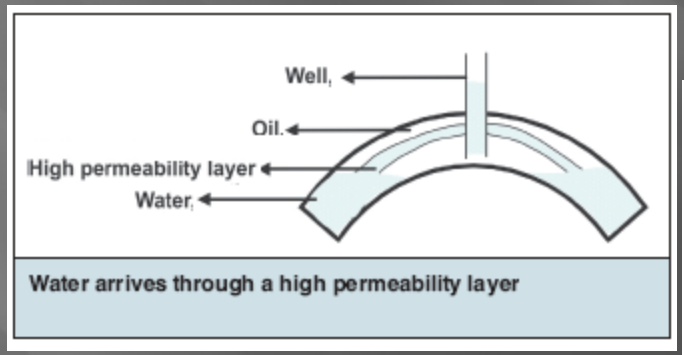
I. Water coning

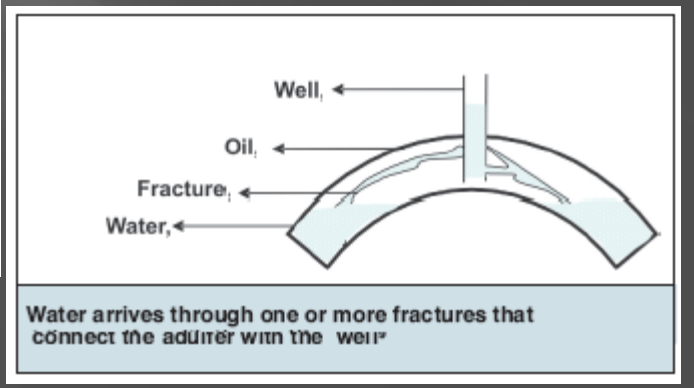




II.Global increase of the water and oil contact

III.Water arrives through a high permeability layer





IV. Water arrives through one or more fractures that connect the aquifer to the well

Main Causes of Water Production

- **Mechanical problems:**
  - Corrosion or wear holes
  - Excessive pressure
  - Formation deformation
  - Fluid invasion in wellbore
- **Completion related problems**
- **Fracturing out of zone**
- **Reservoir depletion**

Well Known Water Shut-off Techniques

- There are exist countless number of techniques such as polymer and polymer/gel injection, different types of gel systems, organic/metallic cross linkers, and combined between them, mechanical solution, cement plug solution and other hundreds of different mechanical and chemical methods for water shut-off.

- **But anyway our experience says that In many cases, innovative water-control technology can lead to significant cost reduction and improved oil production**

Polymer Flooding Treatment

- Polymer flooding (Chemical Enhanced Oil Recovery - EOR) is a very important method for improving the water flooding sweep efficiency to increase oil recovery and reduce water production. It can yield a significant increase in percentage recovery by reducing the water production and improving the recovery when compared to the conventional water flooding in certain reservoirs.

- Polymer types:
  - biopolymers
  - synthetic polymers

Different Polymers Comparison

Type	Advantages	Disadvantages
PAA: Polyacrylamide (Partially hydrolyzed)	- high yield in normal water - high injectivity	- not salt resistance - shear sensitivity - O2 sensitivity
Hydroxyethylcellulose (HEC)	- well soluble - resistance salt	- pH sensitivity - Fe+3 sensitivity - low temperature resistance - no structure viscosity
Biopolysaccharide (Xanthan, Scleroglucan)	- high yield in salt water - shear stable - temperature stable - low adsorption value	- problem of injection - bacteria sensitivity - O2 sensitivity - high cost
Co- and Terpolymers	- well soluble - salt resistance - temperature stable - shear stable	- O2 sensitivity - high cost

Source: Moawad T., "A stimulation case study for economically improved oil recovery and water Shut-off strategies on the basis of the stratified high temperature oil reservoir" Ph.D Tu-Clausthal, Germany, (2004).

Water Shutoff Technology

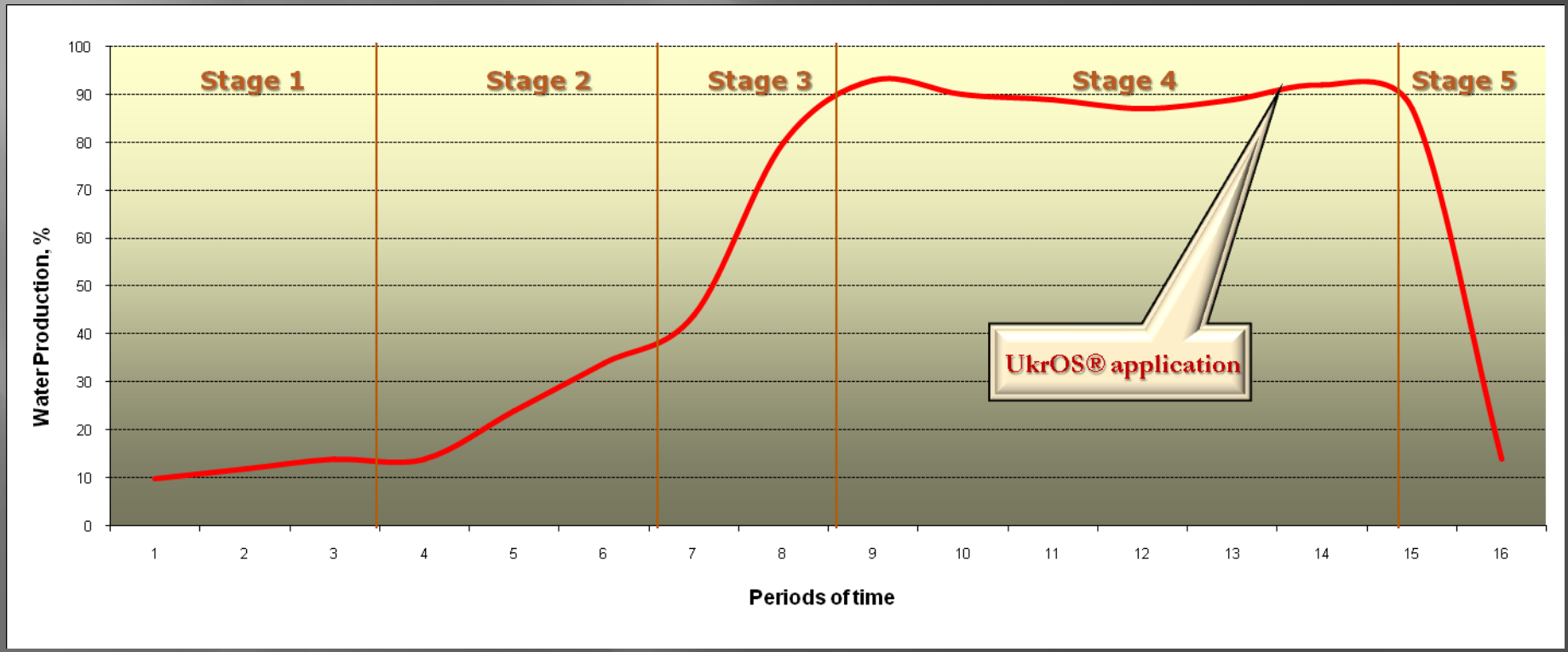
- Water Shutoff Technology is defined as operation that hinders water to reach and enter the production wells
- Is protected by patent №79173
- Technology is the injection operation of the polymer composite into the oil or gas well, based on its geographical properties
- Technology allows to insulate and liquidate the water flow of the oil and gas wells
- Technology helps increase **up to 35%** of oil and gas productivity on the wells, where 55%-75% from the original geological reserves in the bowels of the earth is not extracted with existing methods of the exploitation

Effectiveness

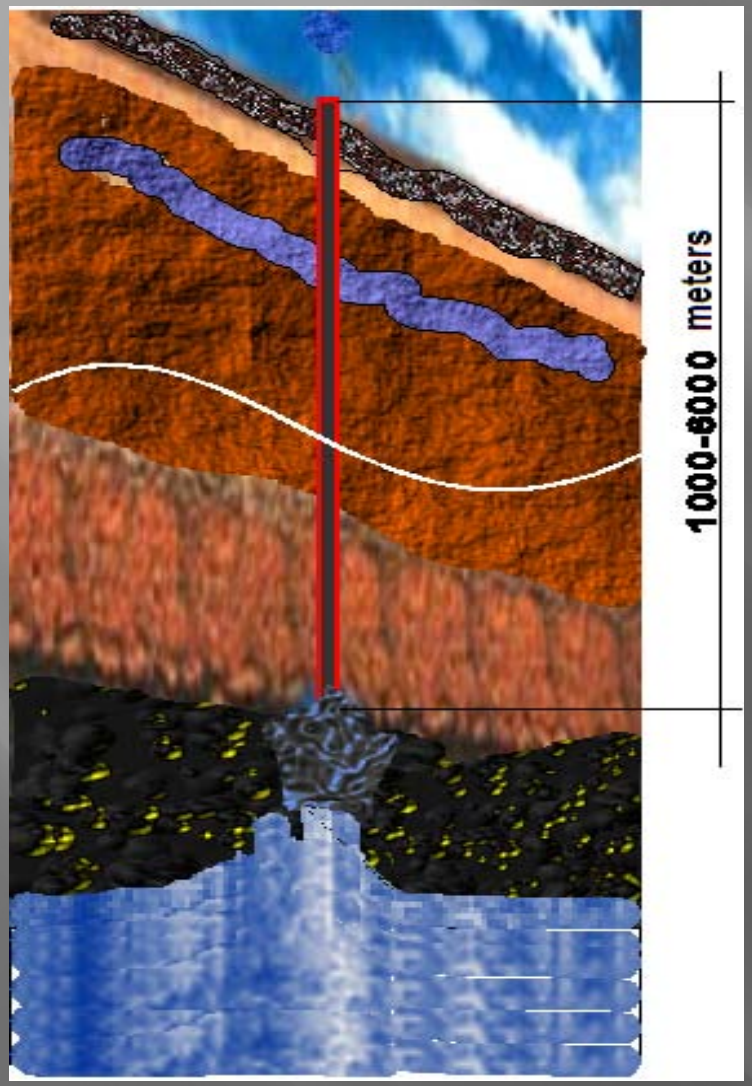
- Known methods of oil extracting provide the coefficient of oil recovery **0.25 -0.45**
- Technology application increases this index till **0.60-0.80**
- 18 years successfully implementations on the Russia and Ukraine oil and gas markets

Water Production Dynamic on Well

Stage1: Water intrusion in the extracted product
Stage2: Constant increase of water yield
Stage3: Sharp increase of the water flow
Stage4: Stabilization of the water production
Stage5: **W**ater shutoff technology application effect



Application Experience

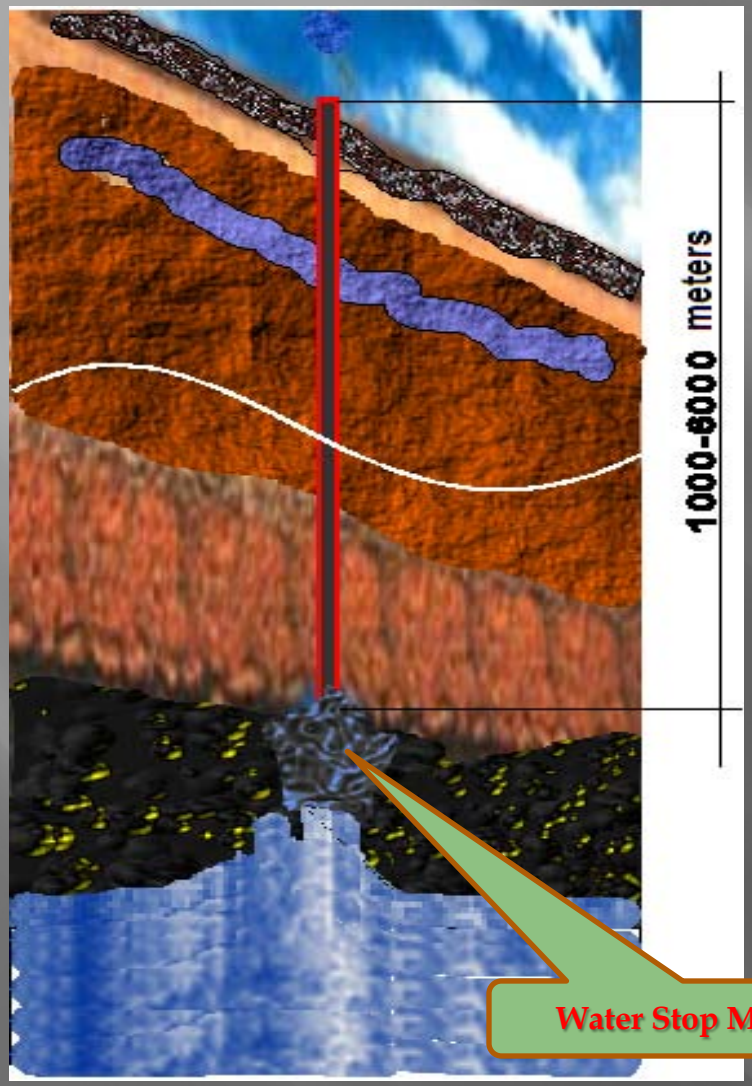


Well Depth range:
from 1000m to 6000 m

Well Bottom Temperature range:
from +60°C to +190°C

Well Bottom Pressure range:
from 1,2MPa to 25MPa

Technology Matter and Duty Cycle



- Analysis of well characteristics data and materials — 15 days
- Preparing well characteristics depended polymer composite — 20 days
- Pumping-in of polymer composite to well — 5 days
- Holding well under the pressure.
- Polymer composite is transforming to complex molecular **Water Stop Membrane** — 25 days

Offers

- Proprietary XXX-Water Shutoff Technology based on patented synthetic polymeric composite
- Special technological cards allowing on the basis of the technical passport and logbook of the well to adapt the technology to each concrete case
- High quality service based on long term scientific and practical experience that brings possibility to adopt research and development groundwork to efficient methods of resolving many different complex tasks