

i.e. 30% for gas, — for oil

#### IV. Background Information Concerning Hydrocarbon Bearing Zones

21. A hydrocarbon bearing zone is a defined interval that contains oil and/or gas at a sufficient level such that oil and/or gas will flow out of the zone and into a well bore, when the pressure in the well bore is

reduced below the pressure in the zone. In reservoir engineering and geological terms, the zone containing oil and gas is normally called a reservoir, and the rock is called a formation. For convenience and clear communication formations may be given names or labels such as M56A or M57B.

"in enough quantity to affect wellbore operations."

22. For a formation to be hydrocarbon bearing it must have sufficient porosity and oil or gas saturation such that it will flow in the presence of a pressure differential. Underground formations are composed of various types of rocks and almost always contain some type of fluid. Most rocks have tiny pore spaces that contain the fluid. Quantification of the pore spaces is expressed as a fraction or percentage of the bulk volume of the rock and termed "porosity". Porosity values range from 0.0% (no pores in the rock) to a high value of approximately 37%.

23. In reservoir engineering terms, a fluid is water, oil or gas or any combination of the three. The volume of water, oil or gas in the pore spaces is expressed as a fraction or percentage of the pore volume, called either oil, water or gas saturation. If all the pore spaces in a rock are full of water then it is said to be 100% water saturated. It is very rare to find a subsurface formation that does not contain some water. Typically, if a formation contains some percentage of water saturation (e.g., 52%), the remainder of the pore spaces will be filled with a hydrocarbon (e.g., the remaining 48%). Hydrocarbon bearing zones, by definition, must contain some level of oil and/or gas saturation. However, if the hydrocarbon saturation is too low then the fluid will not flow.

24. Permeability is the engineering term describing the resistance to flow of a single fluid in a porous formation. Permeability is measured in terms of millidarcies, md, not to be confused with the abbreviation for measured depth (md). In general terms the higher the porosity the higher the permeability. If the rock contains more than one fluid, for example oil and water, then the concept of relative permeability, a