Summary of Common Openhole Logging Measurements

2017.08 Dak

Common openhole logging measurements																	
www.Discovery-Group.com																Dak 2017.08	
This information is available in a spreadsheet that can be filtered and sorted.																	
								Depth of investigation						Borehole Fluid		
Measurement target	General measurement category	*Common measurement name*	*Common curve name*	*Common curve mnemonics*	*WL/ LWD*	*Measurement physics*	*axial resolution, inches*	*Very shallo*	*shallow*	*medium*	*deep*	*centered/ eccentered*	*Measurement direction*	*water*	*oil*	*air*
borehole diameter	Correlation/Lithology	caliper	caliper	CALI, CAL, HD	WL	mechanical arm	none	none					azimuthal	x	x	x
borehole diameter	Correlation/Lithology	caliper	caliper	CALI, CAL, HD	LWD	acoustic	none	none					azimuthal	x	x	
formation water resistivity	Correlation/Lithology	spontaneous potential	SP	SP	WL	electrical; natural	varies		shallow			centered	omnidirectional	x		
lithology	Porosity/Lithology	Density	bulk density*	RHOB, DEN, ZDEN	both	nuclear; gamma ray	18	1.5				eccentered	azimuthal	x	x	x
lithology	Porosity/Lithology	Density	photoelectric effect	PE, Pe, PEF	both	nuclear; gamma ray	18	1				eccentered	azimuthal	x	x	x
lithology	Porosity/Lithology	Neutron	neutron porosity*	NPHI, PHIN	both	nuclear; neutrons	24	6				eccentered	azimuthal	x	x	x
lithology	Porosity/Lithology	Sonic/Acoustic	traveltime*	DT, DTC, DTCO	both	acoustic	6 to 12	5-Jan				centered	omnidirectional	x	x	
lithology	Porosity/Lithology	neutron spectroscopy	(lithologies)	(named volumes)	both	nuclear; neutrons	12	6				centered	omnidirectional	x	x	x
lithology/shale volume	Correlation/Lithology	gamma ray	gamma ray	GR, SGR	both	nuclear; gamma ray, natural	18		12			either	omnidirectional	x	x	x
lithology/shale volume	Correlation/Lithology	gamma ray	potassium	POTA, K	both	nuclear; gamma ray, natural	18		12			either	omnidirectional	x	x	x
lithology/shale volume	Correlation/Lithology	gamma ray	uranium	URAN, U	both	nuclear; gamma ray, natural	18		12			either	omnidirectional	x	x	x
lithology/shale volume	Correlation/Lithology	gamma ray	thorium	THOR, TH	both	nuclear; gamma ray, natural	18		12			either	omnidirectional	x	x	x
lithology/shale volume	Correlation/Lithology	spontaneous potential	SP	SP	WL	electrical; natural	varies		shallow			centered	omnidirectional	x		
porosity	Porosity/Lithology	Density	bulk density	RHOB, DEN, ZDEN	both	nuclear; gamma ray	18	1.5				eccentered	azimuthal	x	x	x
porosity	Porosity/Lithology	Neutron	neutron porosity	NPHI, PHIN	both	nuclear; neutrons	24	6				eccentered	azimuthal	x	x	x
porosity	Porosity/Lithology	Sonic/Acoustic	traveltime	DT, DTC, DTCO	both	acoustic	6 to 12	5-Jan				centered	omnidirectional	x	x	x
porosity, pore size	Porosity/Lithology	nuclear magnetic resonance	propagation time	T1, T2	both	electromagnetic	4 to 18	1 to 3	12 to 16			both	either	x	x	x
water saturation	Resistivity	induction	deep induction	ILD, DIL	WL	electrical; sourced	12, 24, 48				90 to 120	centered	omnidirectional	x	x	x
water saturation	Resistivity	induction	medium induction	ILM, MIL	WL	electrical; sourced	12, 24, 48			30 to 60		centered	omnidirectional	x	x	x
water saturation	Resistivity	induction	shallow (w/induction)	SN, SFL	WL	electrical; sourced	12, 24, 48		10			centered	omnidirectional	x		
water saturation	Resistivity	laterolog	deep laterolog	LLD, DLL	WL	electrical; sourced	24				50 to 84	centered	omnidirectional	x		
water saturation	Resistivity	laterolog	shallow laterolog	LLS, SLL	WL	electrical; sourced	24		24 to 36			centered	omnidirectional	x		
water saturation	Resistivity	laterolog	very shallow (Rxo)	RXO, MSFL	WL	electrical; sourced	1 to 2					eccentered	azimuthal	x		
water saturation	Resistivity	propagation (induction)	deep phase	P56H, P56L, P44H	LWD	electrical; sourced	18				40 to 56	centered	omnidirectional	x	x	x
water saturation	Resistivity	propagation (induction)	deep attenuation	A56H, A56L, A44H	LWD	electrical; sourced	18				40 to 56	centered	omnidirectional	x	x	x
water saturation	Resistivity	propagation (induction)	medium phase	P24H, P24L	LWD	electrical; sourced	18			20 to 34		centered	omnidirectional	x	x	x
water saturation	Resistivity	propagation (induction)	medium attenuation	A24H, A24L	LWD	electrical; sourced	18			20 to 34		centered	omnidirectional	x	x	x
water saturation	Resistivity	propagation (induction)	shallow phase	P09H, P09L	LWD	electrical; sourced	18		9 to 20			centered	omnidirectional	x	x	x
water saturation	Resistivity	propagation (induction)	shallow attenuation	A09H, A09L	LWD	electrical; sourced	18		9 to 20			centered	omnidirectional	x	x	x

The table on the previous page is also available as a searchable Excel spreadsheet.

General comments:

General Measurement Categories are those used in Discovery Group training courses. The measurements fall under the categories as follows:

Correlation/Reservoir: Gamma ray, Spontaneous Potential (SP), Caliper, Tension.

Porosity and lithology: Acoustic slowness, Density (bulk density and photoelectric effect), Neutron porosity, combinations (pairs or triads) of the previous measurements, Nuclear Magnetic Resonance, Dielectric logs, Gamma Ray and Neutron Spectroscopy.

Resistivity/Fluid saturation: Induction (including LWD propagation and 2D and 3D wireline logs), Laterologs, and microresistivity (Rxo)logs.

Common measurement names are generic names for the measurements. The asterisk (*) after some porosity measurements indicates that the three common measurements (acoustic, bulk density and photoelectric effect, neutron) are used in combination to estimate lithology.

Common curve mnemonics are just a few of the many mnemonics (abbreviations) used by the industry. Some are company-specific or processing-specific. See the SPWLA website (www.SPWLA.org) for searchable mnemonics lists.

WL/LWD indicates whether a particular measurement is made with wireline tools, Logging While Drilling tools, or both.

Axial resolution is the resolution of the measurement along the axis of the logging tool, often also called "vertical resolution." By industry definition, 90% of the signal comes from within the length listed.

Depth of investigation indicates the distance away from the logging tool that the measurement senses into the borehole. Like axial resolution, 50% of the signal comes from within the distance listed.

Centered/eccentered and **Measurement direction.** Tools are either approximately centered in the borehole or eccentered; that is, their sensors are pressed against the borehole wall, usually because their depth of investigation is so small. With sensors centered in the borehole, the sensors are usually omnidirectional; that is, they respond to (and average) properties completely around the borehole. With eccentered tools, the sensors usually respond only to that portion of the borehole with is directly in front of them, the part of the borehole with which they are making contact.

Borehole fluid applies to electrical and acoustic measurements. Acoustic measurements need liquid in the borehole; gas or air attenuates the measurement signal too much. Laterologs need an electrical path from the tool to the formation, so oil-based mud and air will not allow the measurement to work, while induction logs will work in any borehole environment.

This document is intended to be updated periodically as necessary to include new and corrected information.

Questions and comments about this document are welcomed and encouraged. Please contact Dan Krygowski at The Discovery Group; DanKrygowski@Discovery-Group.com