

Well Data Management and Petrophysics Workflows and Standards

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Introduction

Work-data flows

- Exploration department (illustrated today)
 - cooperation with E&P Application and Data Management department (E&P ADM) especially focused on input data organization for PPs (coordination of requests; download of Diskos data, or from ftp sites; preparation of restricted folder; etc.)
 - E&P ADM delivers Petrophysicist (PP) output by loading data in Recall, Petrel, GeoFrame
- Development/producing assets
 - much less interaction with E&P ADM
 - Petrophysical data are requested, shared and handled inside the asset group
 - E&P ADM is needed at the end of critical phases (track working/reference projects when crossing decision gates or model reviews)
- In drilling campaigns cooperation with E&P ADM is important to make sure well data are handled and archived properly. This includes delivery of final data/reports to authorities and partners; storage of physical items like final reports but also cores, cuttings, fluid samples, etc.)
- Shortcut (!)

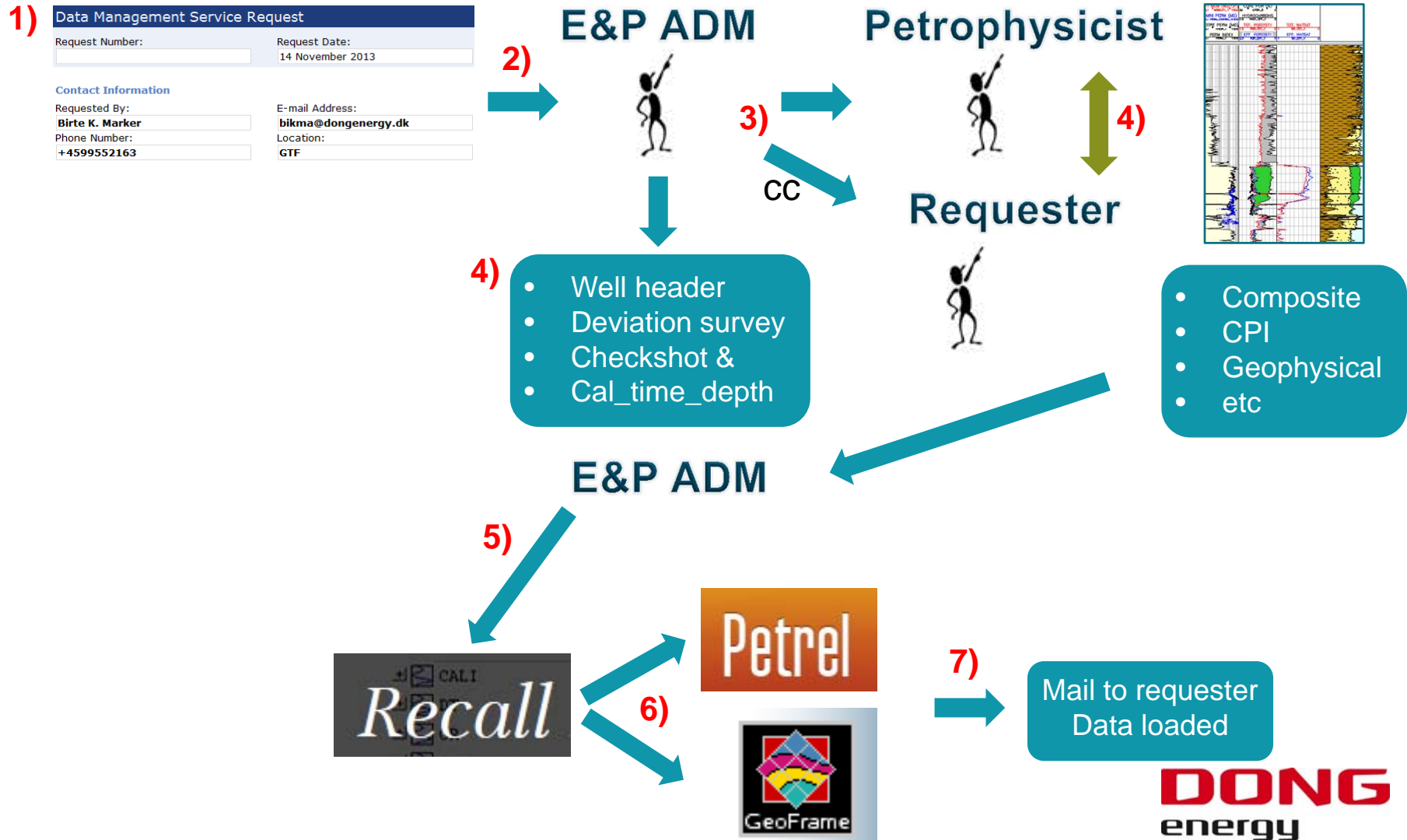
Introduction

Standards

- Data have standardized units, colour coding and display formats (logs, CPIs, cores, mud log gas readings, shows, etc.)
- Petrophysical methodologies – periodically discussed in petrophysicists network meetings (not part of this presentation)
- Standards are collected and reported in DONG ENERGY internal web portal Navigator and they are re-discussed when needed

Well Data for Exploration Workflow

Exploration requests well data



Well Data for Exploration Data Management Service Request

Data Management
Typical timing:
1-3 days per well

Well Data Types to load:

Recall QC'ed data types		
<input type="checkbox"/> New Well (Headerinfo)	<input type="checkbox"/> Deviation Survey	<input type="checkbox"/> Composite
<input type="checkbox"/> CPI	<input type="checkbox"/> Geophysical	<input type="checkbox"/> Fluid Substitution
<input type="checkbox"/> Checkshot	<input type="checkbox"/> CAL_TIME_DEPTH	<input type="checkbox"/> Core Plugs
<input type="checkbox"/> Miniperm	<input type="checkbox"/> Whole Core	<input type="checkbox"/> Sidewall Core Plugs
<input type="checkbox"/> FT	<input type="checkbox"/> CPI_PN	<input type="checkbox"/> Casing
<input type="checkbox"/> Core	<input type="checkbox"/> DST	<input type="checkbox"/> Perf
<input type="checkbox"/> Show	<input type="checkbox"/> Markers	
Recall not DONG QC'ed Data Types		
<input type="checkbox"/> Composite Diskos	<input type="checkbox"/> Geophysical Diskos	

Petrophysics

Request forwarded for evaluation.

Typical timing:

COMPOSITE: (1 hr - 1 day per well)

CPI: (1 - 4 days per well)

FLUID SUB: (5+ days per well)

Non-routine

Can be created if necessary.

Recommendations:

1. Always discuss with the Petrophysicist objectives and timeline.
2. Go back to both the assigned PP and the assigned DM if priority has changed or anything is not important anymore.

COMPOSITE

GR
DEN
NEU
RES_DEP
RES_MED
RES_SHA
AC_COMP
AC_SHEAR
...

GEOPHYSICAL

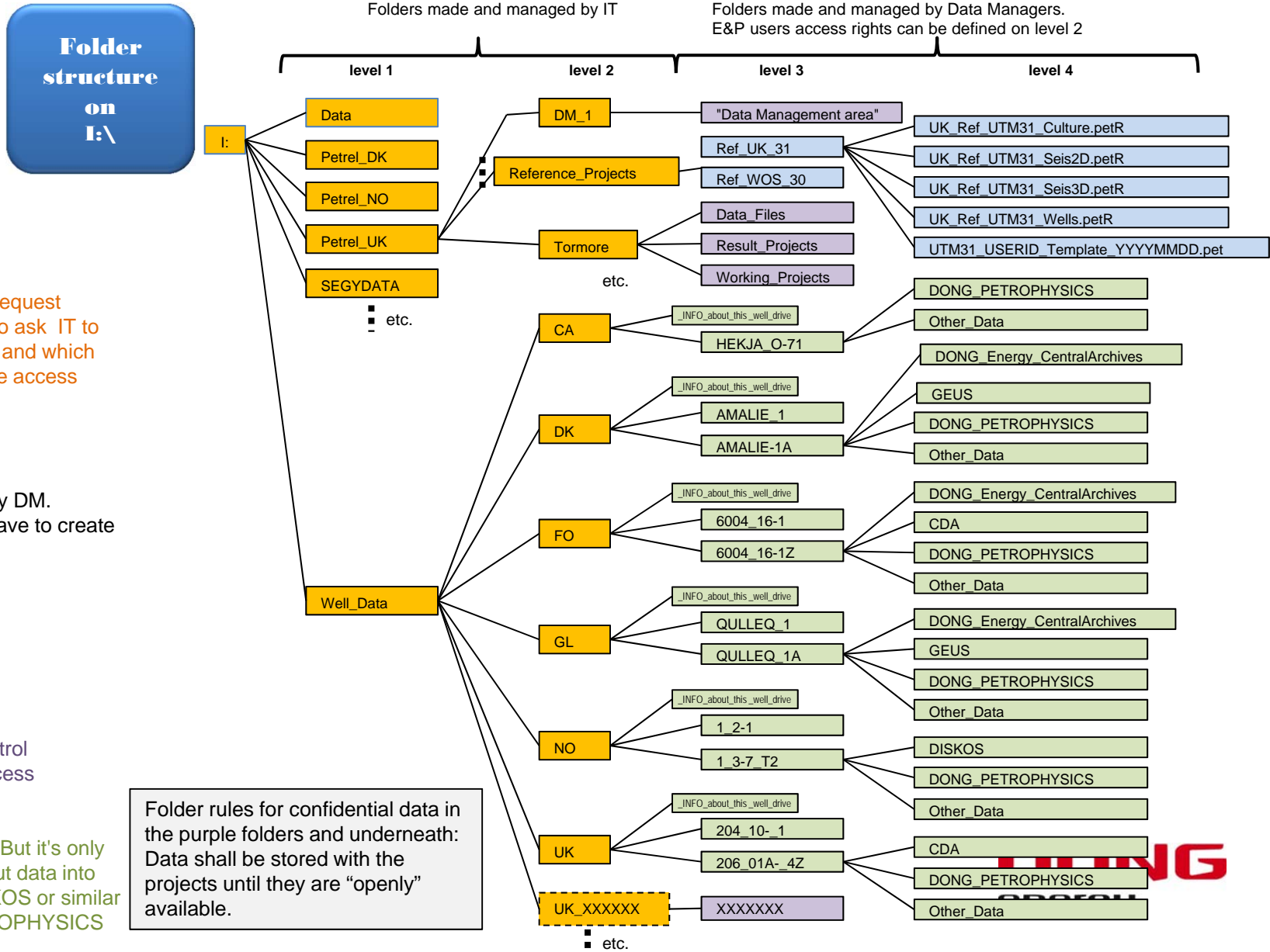
AC_CMP_GP
AC_SHR_GP
DEN_GP
VP
VS
AC_IMP
PR
...

CPI

VSHALE
POR_TOT
POR_EFF
SW_TOT
SW_EFF
PERM
RESERVOIR
PAY
...

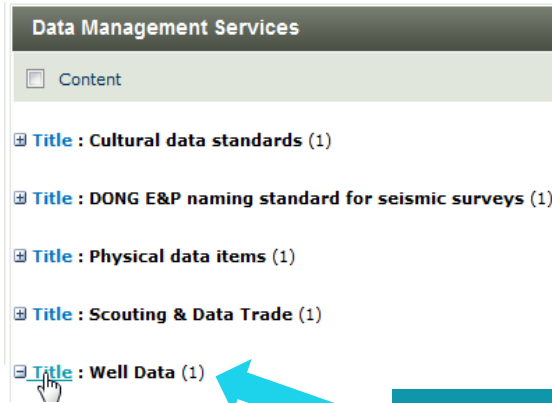
Data Management Services

Well Data Standards – Folder Structure



Data Management Services

Well Data Standards



What to be found on Well Data

- Naming and writing rules for wells in DONG ENERGY - Full version in Navigator (22877)
- Well attributes for header information in Recall, Petrel and GeoFrame
- Naming of log curves for DONG ENERGY own interpretations - Mnemonics - Full version in Navigator (22872)
- Naming of well picks and markers - Navigator (39284)
- Which data to be found in Recall, Petrel and GeoFrame
 - Spreadsheet overview for each UTM zone in each country
- How to connect and download from Recall

Data Management Services

Well Data Standards - Log Curves Mnemonics

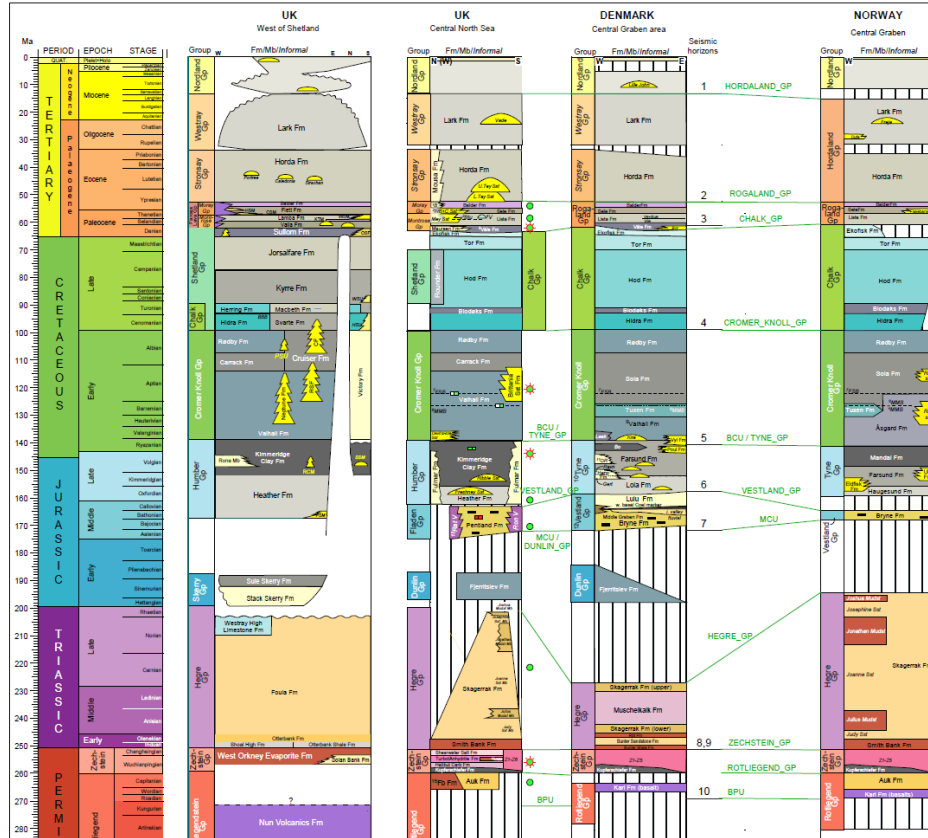
Version 49		Recall Date: 31-07-2012	Red: New mnemonics used by petrophysicist, but not implemented in Recall dictionary yet.							Nye	Nye		
		Should be loaded in Recall, but not in Petrel											
		These spreadsheet is based on the POSC PWLS V1.0 standard is primarily used for acquisition data (1.0.1), the POSC PWLS V2.0 is used for joined and interpreted data (20_1000) and our own standard.											
mnemonics DONG Standard for own interpreted logs	LIS mnemonic s used for LIS format export from Recall	Additional LIS format Import ALIAS in Recall using special Recall tables	curve_description	business_value	property_type	unit_type	display_left	display_right	QC_min	QC_max	Logarithmic	Recall PLOT COLOUR	
COREPLUGS													
Recall table CORE													
CORENUMBER_RCA	CORE		Core Number - Core Plugs	HIGH	Identifier	Text	50	0	0	10000		BLACK	
CPOR	CPOR	PHI, POR, CP, CPHI, PHIC, PCOR, PORC, PHIE, PHIT, PHIH, PORH, PORHC, PHIHC, CPHH, CPHH, CPORH	Core Porosity	HIGH	Porosity	Porosity	50	0	0	50		BLACK	
CPORCT	CPCT	CPORC	Core Porosity Corrected for Clay Bound Water at Reservoir Condition	HIGH	Porosity	Porosity	50	0	0	50		BLACK	
CPORF	PORF	PHIF, PORFC, PHIFC, CPHIF, PF, PFCO, PORF	Core Porosity, Fluid Summation	HIGH	Porosity	Porosity	50	0	0	50		BLACK	
CPOROB	PORB	PHIOB, POROB, CPHIOB, CPOB, PHIOB, PORHOB, CPHIOB, CPHO, CPORHOB, CPOR800, CPORRES, PORB, POHB	Core Porosity - Overburden Corrected	HIGH	Porosity	Porosity	50	0	0	50		BLACK	
CPORV	PORV	PHIVC, PORVC, PHIV, CPHIV, CPHV, PORV	Core Porosity, Vertical PLUG	HIGH	Porosity	Porosity	50	0	0	50		BLACK	
CPORVOB	POVB	PHIVOB, PORVOB, CPHIVOB, CPVO, POVB, PVOC	Core Porosity, Vertical PLUG - Overburden Corrected	HIGH	Porosity	Porosity	50	0	0	50		BLACK	
CSG	CSG	SGAS, CSG, SG, SGC	Core Gas Saturation	HIGH	Gas_Saturation	Standard_Volume_Ratio	100	0	0	100		BLACK	
CSO	CSO	SOIL, CSO, SOC, SO	Core Oil Saturation	HIGH	Oil_Saturation	Standard_Volume_Ratio	100	0	0	100		BLACK	
CSW	CSW	SWAT, SWC, SW	Core Water Saturation	HIGH	Water_Saturation	Standard_Volume_Ratio	100	0	0	100		BLACK	
GRDE	GRDE	GRDN, CGDN, CGRD, GRDENS, GDN, GDNC, GRD, GRDC, GD, SAMPGDEN	Core Grain Density	HIGH	Grain_Density	Density	2.5	3	2	5		BLACK	
KHKL	KHKL	KHAC, KAHC, KAKC, KHAK, KHK, KHKC, CKAH, CKHK	Klinkenberg Corrected Gas Permeability, Horizontal	HIGH	Horizontal_Permeability	Permeability	0.1	1000	0	20000	log	BLACK	
KHL	KHL	KLH, CKHL, KHLC	Liquid Permeability, Horizontal	HIGH	Horizontal_Permeability	Permeability	0.1	1000	0	20000	log	BLACK	
KHLOB	KHLB	KLHOB, KHLB	Liquid Permeability, Horizontal - Overburden Corrected	HIGH	Horizontal_Permeability	Permeability	0.1	1000	0	20000	log	BLACK	
KHOB	KHOB	KHAOB, KAHOB, KHOR800, KHORRES	Overburden Corrected Gas Permeability, Horizontal	HIGH	Horizontal_Permeability	Permeability	0.1	1000	0	20000	log	BLACK	
KHOR	KHOR	CKHA, KHA, KAH, KH	Gas Permeability With Air/Nitrogen, Horizontal	HIGH	Horizontal_Permeability	Permeability	0.1	1000	0	20000	log	BLACK	
KVER	KVER	CKVA, KVA, KAV, KV	Gas Permeability With Air/Nitrogen, Vertical	HIGH	Vertical_Permeability	Permeability	0.1	1000	0	20000	log	BLACK	
KVKL	KVKL	KVAC, KAVC, KVAK, KVK, KVKC, CKVK	Klinkenberg Corrected Gas Permeability, Vertical	HIGH	Vertical_Permeability	Permeability	0.1	1000	0	20000	log	BLACK	
KVL	KVL	KLVC, CKVL, KVL	Liquid Permeability, Vertical	HIGH	Vertical_Permeability	Permeability	0.1	1000	0	20000	log	BLACK	
KVLOB	KVLB	KLVOB, KVLB	Liquid Permeability, Vertical - Overburden Corrected	HIGH	Vertical_Permeability	Permeability	0.1	1000	0	20000	log	BLACK	
KVOB	KVOB	KVAOB, KAVOB	Overburden Corrected Gas Permeability, Vertical	HIGH	Vertical_Permeability	Permeability	0.1	1000	0	20000	log	BLACK	
LITH	LITH	MAINLITH, LITHMAIN, LITHSEC, SWSLITH	Plug LithoLog	HIGH	Litho_Description	Text						BLACK	
MDEPTH_RCA	MDEP		Core Depth Along Hole - Routine Core Analysis	HIGH	Measured_Depth	Length						BLUE	
SAMPDIAM	PLUD	PLUG_DIAMETER, PLUD	Core Sample Diameter	HIGH	Core_Diameter	Cylinder_Diameter	5	1	0	10		RED	
SMID_RCA	SMID		Sample UID - Core Plugs	HIGH	Sample_Number	Text						BLACK	
MINIPERM													
MDEPTH_MP	MDEP		Core Depth Along Hole - MiniPermeameter	HIGH	Measured_Depth	Length						BLUE	
MINI_PERM	MPER		Probe Permeability	HIGH	Horizontal_Permeability	Permeability	0.1	1000	0	20000		BLACK	
Recall table PRESSURE													
COMMENT	REM		Remark	HIGH	Description	Text						BLACK	
FPRESS	PRES	FMP	Formation pressure	HIGH	Pressure	Pressure	0	1000	0	1500			
FTEMP_FT	TEMP		Probe temperature	HIGH	Temperature	Temperature	0	600	0	600			
MDEPTH_FT	MDEP		Core Depth Along Hole	HIGH	Measured_Depth	Length						BLUE	
MOBILITY	MOBL	MOB	Mobility	HIGH	Mobility	Mobility	0.1	1000	0	20000			
RUN_NO	RUN		Run number	HIGH	Identifier	Text						BLACK	
SYMBOL_FT	SYMB		Pattern	HIGH	Identifier	Text						BLACK	
TEST_NO_FT	TEST		Test Number	HIGH	Sample_Number	Text						BLACK	



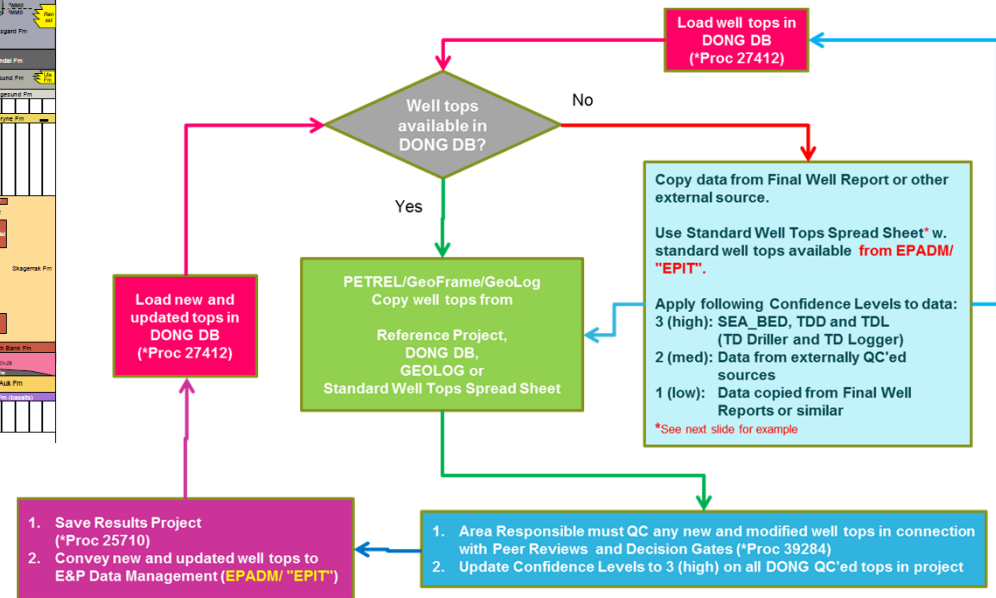
Data Management Services

Well Data Standards – Stratigraphy, Well Picks and Markers

Standard stratigraphic scheme for the WoS and CNS area 2014



- Chronostratigraphy in DONG ENERGY follows the work of the International Commission on Stratigraphy ICS
- Lithostratigraphy in DONG ENERGY
 - Ongoing project to establish official Corporate standard Lithostratigraphy Charts for footprint Areas/Basins



- Manual input of data
- Peer Review approval
- EPADM/EPIT update of DB
- Geolog/Petrel work
- Area responsible

*Procedures refer to Navigator Doc No

Data Management Services Procedures on Definition of Standards

Procedures
<ul style="list-style-type: none"> ■ Well Naming Standard ■ Well Marker Standard ■ Mnemonics to be Used for Log Interpretation and how to define new ■ Naming and how to load CHEKSHOTS, CAL_TIME_DEPTH and the GEOPHYSICAL log ■ Receiving new DONG Operated Seismic and Well Data - Norway ■ Receiving non-operated Well and Seismic Data - Norway

	E&P ADM Data Management Procedures Subject:	Receiving new DONG Operated Well and Seismic Data - Norway (EPIT-13)	Level: 
	Responsible: DatAdm		Approved by: TOHAN
Version: 1	Document number: 3.100		29/06/2009
Document users: EPIT DK, Exploration NO			

- 1) Objective
- 2) Scope
- 3) Responsibility and Authority
- 4) Procedure
 - 4.1) LOGS
 - 4.2) DEVIATION DATA
 - 4.3) CORE DATA
 - 4.4) GEOCHEMISTRY
 - 4.5) BOREHOLE SEISMIC DATA
 - 4.6) GEOLOGY
 - 4.7) TEST DATA
 - 4.8) SEISMIC FIELD DATA (Seismic tapes, raw)
 - 4.9) SEISMIC PRE-STACK DATA (Gathers)
 - 4.10) SEISMIC POST-STACK DATA (Raw Stack)
 - 4.11) ELECTROMAGNETIC DATA
- 5) Documentation
- 6) Enclosures / Attachments
- 7) Definitions / Abbreviations
- 8) Basis and References

4) Procedure

Norway:

4.1) LOGS

- **Operations Geologist** receives preliminary log data and puts them on the I-drive in the respectively well folder under another folder called Preliminary data and inform team.
- **Operations Geologist** receives final log data from the contractor on paper and CD for QC. Data QC is performed by Petrophysicist. Other QC e.g. heading info is done by Operations Geologist.
- If OK: **Operations Geologist** orders X number of paper copies and CD's for distribution. If not OK: **Operations Geologist** sends it back for correction.
- **Petrophysicist** puts the final log data into the well folder (I-drive) under a folder called Final data and informs team and EPIT about it.
- **Operations Geologist** registers all final documents in the "report and data tracker sheet".
- **Operations Geologist** delivers the data to the EPIT - document administrator, for registration and distribution to partners and Logtek.
- **Document Administrator** registers the original data in ProArc and Lynx and archives the physical items.
- **Document Administrator** distributes to petrophysicist, partners and Logtek.
- Logtek prepare the data for reporting to DISKOS and send it to petrophysicist for approval.
- **Well Administrator** to follow up data & document the "Report and Data Tracker sheet".
- **Well Administrator** load data into Recall as described in Recall procedure.

Data Management Services Overview of Available Data in Recall, Petrel and GeoFrame

		Highlight data entry		Clear data entry highlighting		D = Dong QCed / Interpreted Data Ex = External data		Current date: 28/04/2014		Petrel referenceproject: NO_Ref_UTM31_Wells.petR GeoFrame masterproject: WM_NO31																									
WELLBORE	DEV SURV			WELLPATH			FINAL CHECKSHOT			FINAL CAL_TIME_DEPTH			COMPOSITE			CPI			CPI PDF	GEOPHYSICAL			FLUID_SUBSTITUTION			CORE PLUGS		MINIPERM		WHOLE CORE		SIDEWALL COREPLUGS		FT	
	Recall	Petrel	GF	Recall	Petrel	GF	Recall	Petrel	GF	Recall	Petrel	GF	Recall	Petrel	GF	Recall	Petrel	GF		Recall	Petrel	GF	Recall	Petrel	GF	Recall	Petrel	Recall	Petrel	Recall	Petrel	Recall	Petrel		
1/2-2	12-Mar-09	12-Mar-09	D																																
1/3-1	31-Mar-09	31-Mar-09	D		31-Mar-09																														
1/3-2	17-Jun-10	17-Jun-10	D		29-Apr-10	Ex																													
1/3-3	27-Oct-10	27-Oct-10	D		29-Apr-10	Ex																													
1/3-4	29-Jul-10	29-Apr-10	D		29-Apr-10	Ex																													
1/3-5					12-Nov-09																														
1/3-6	22-Jan-08	22-Oct-08	D		22-Jan-08	Ex																													
1/3-7																																			
1/3-7 T2																																			
1/3-7 T3	15-Apr-10	15-Apr-10	D																																
1/3-8	17-Jun-10	17-Jun-10	D		17-Jun-10	Ex																													
1/3-9 S	27-Oct-10	27-Oct-10	D																																
1/3-9 ST2	26-Oct-10	26-Oct-10	D		06-Jan-11																														
1/3-10	16-Apr-10	16-Apr-10	D		16-Apr-10																														
1/3-10 A	16-Apr-10	16-Apr-10	D		none	none																													
1/3-11	21-Nov-10	21-Oct-10	D		11-Jun-10																														
1/3-11 T2	21-Nov-10	21-Oct-10	D		none	none																													
1/3-12 S	30-Oct-13		D		none	none																													
1/5-2	26-May-11	26-May-11	D		26-May-11																														
1/5-3 S																																			
1/5-3 ST2																																			
1/5-4 S	26-May-11	26-May-11	D																																
1/6-1	26-May-11	26-May-11	D																																
1/6-2	26-May-11	26-May-11	D																																
1/6-3	09-Apr-13																																		
1/6-3 T2																																			
1/6-3 T3																																			
1/6-4	26-May-11	26-May-11	D																																
1/6-5	26-May-11	26-May-11	D																																
1/6-6	26-May-11	26-May-11	D																																
1/6-7	26-May-11	26-May-11	D																																
1/9-1	26-May-11	26-May-11	D		26-May-11																														
1/9-2	26-May-11	26-May-11	D		26-May-11																														
1/9-3																																			
1/9-3 R																																			
1/9-4	26-May-11	26-May-11	D		26-May-11																														
1/9-5	26-May-11	26-May-11	D		26-May-11																														
1/9-6 S	26-May-11	26-May-11	D		26-May-11																														
1/9-6 SR																																			
1/9-7	27-May-11	27-May-11	D																																
1/9-7 T2	27-May-11	27-May-11	D																																
1/9-7 T3																																			

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