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# Best and worst practise with UK well data management – a BGS perspective

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#### **Brief Outline**

- Introduction to British Geological Survey (BGS) and its role
- BGS role in managing subsurface data
- Data lifecycle : life and afterlife
- Data management examples: good and bad
- Starr: example of data compilation / repurposing
- Conclusions



#### What does BGS do?

- Earthquakes
- <u>Geomagnetism</u>
- Groundwater floods
- <u>Sinkholes</u>
- <u>Coastal Landslides</u>
- Shale Gas prospectivity and risks



### BGS role for UK: past and present



- British Geological Survey (BGS) *advises* government, agencies & public about risks and resources for the UK landmass & UKCS
- Impartial information provided to all parties on an equal basis
  - Then and now: Energy security
    - 1835: BGS setup to map UK coalfields for Industrial Revolution
    - UKCS oil discoveries results from BGS's offshore mapping
    - Now seen as a direct threat to UK national security







#### **Parameterised Modelling**

Annex B: Completion status of the modelling workflow for delivering the EMP Kev Borehole Databases eg SOBI or BoGE Completed Workflows Creation of Partially complete workflow Lithostrat borehole thostratigraphy Database Systems ublication and del of she Workflow links only possible cross-section generation of and surfaces stick plots Itiple outputs Constraining with significant effort surfaces including DEM Automatic / semi-automatic we need Propert workflows links teration as data **3D Geological Model** volume Lithology Voxel Model Build Voxel mode Variogram Multiple stochast Publication of (no always required nor Illing usi aeostatistics scale Lithology models desirable everywhere) Parameterised Multiple Denormalised PropBase Calculation of Publication of Property Property operty / lithol operty datase erties through property mode QueryLave Dataset(s lithology grid Model Database Sys Conceptual Define and Section of Section and Conceptual Concenter Conceptual Conceptual Conceptual through to parameterised process models Parameterised Validate result Groundwater Input model data Parameterise Output results an Publication of Grid Setup Process model Time-ser



## BGS advice :present and future

- UK faces simultaneous challenges with:
  - Future Energy Security
  - Anthropogenic Environmental Change
- BGS advises government and UK public on:
  - Reserves estimation
  - Potential new resources
    - Shale Gas, CBM, UCG
  - Gas storage & waste from existing energy sources
    - CCS, RADWASTE
- BGS advise regulators about associated risks
- BGS provides:
  - Unique data and diverse scientific expertise to interpret it
  - Advice based on scientific understanding of processes
- UK and devolved governments decide policy

## Policy and consent

A mix of sand, water and chemicals are injected into the borehole Recovered water is taken to a treatment plant

Methane flows out of borehole and is used to generate electricity or fed into the gas grid

#### Hydraulic Fracturing

Hydraulic fracturing or 'fracking', involves the injection of water, sand and chemicals at high pressure into horizontally drilled boreholes. The pressurised mixture causes the shale to crack. These fissures are held open by the sand particles so that methane from the shale can flow up the borehole.



Kilometres

- UK is densely populated and environment is under stress
- Growing tension between:
  - need for national infrastructure and energy security
  - desires to limit development
- UK is not the same as USA
- UK public expect industrial regulation in a crowded island
- Government can licence
   industry activities
- Also need a "social licence" to operate with public consent

#### BGS: data to support decisions



#### The Borehole Material Collections



- UKCS: BGS access through CDA
  - UKCS well and most 3D seismics
- BGS hosts UK National Archive for Geoscience Data:
  - Digital Data: virtual National Geoscience Data Centre (NGDC)
  - Core/samples & records: National Geological Repository (NGR) at Keyworth
  - ~1.5 million UK onshore boreholes registered (majority > 20m deep)
  - BGS is the destination for all deep subsurface data for UK landmass
  - BGS increasingly destination for deep subsurface data for UKCS

## Accessing UKCS Core Data

- NGR has always held BGS core archive
- Major recent additions:
  - 10+ years ago: NIREX Radioactive waste investigations from Sellafield
  - 10 years ago: UK Coal archive
  - 5 years ago: DECC UK onshore oil/gas core
  - 2 years ago: UKCS core moved from Gilmerton (Edinburgh)
- All UK core regardless of origin now consolidated after decades of fragmentation
- One of the largest public geological data centres in the world
- Total of 600km+ core from 22,500 wells/boreholes
  - All available for anyone to view and sample



#### Accessing UKCS Core Data



#### Accessing UKCS Core Data







# National Hydrocarbon Data Archive

National Hydrocarbons Data Archive

- UKCS data management rests with industry
- DECC petroleum licences require all UKCS data preserved in perpetuity in usable condition and this obligation survives:
  - data release;
  - licence relinquishment;
  - decommissioning;
  - and in some cases licence equity/asset sales
- Obligation ONLY ends by archiving data in NHDA
  - Effectively donating data to BGS for "UK national good"
- NHDA now holds ~102 (>1%) wells & several seismic surveys
- Served by CDA to industry and from BGS to academics
- New business models being investigated to enhance uptake

#### BGS data role for UK landmass

- BGS collates deep digital data geophysical log for UK wells
  - Crucial to subsurface understanding
  - individual deep boreholes of great significance
- 2000: data access by goodwill
  - > 2500 mostly poor water well
- 3 crucial datasets now held by BGS and available for science
- NIREX (now NDA) Sellafield radioactive waste disposal data
  - Digital dataset logs of highest quality, accessed for BGS
- Now ~5000 wells, many high quality deep data



#### UK Coal well digital log data



- Variable geographic coverage
  - High: East Midlands & Yorkshire
  - Lower: West Midlands, Lancashire, Durham, Kent
  - Poor: South Wales, Scotland, exploration areas (eg Oxfordshire)
- Logs acquired 1950-1995
  - Non-standard coal logging suite
  - Quality highly variable but improving with time
  - Units and tools standardised with time
  - Dipmeter then FMS in later wells
- Metadata quality very poor
  - LIS header incomplete / empty
  - Well name on tapes only so often data cannot be matched to wells



# UK Oil data coverage

- UK Oil deep geophysical log data increasingly available to BGS science
  - 20 years ago: hand digitised deep well log data only + a little digital data
  - 3 years ago: large scale machine log vectorisation
- BGS now part of DECC's data management procedure
  - Now: systematic collection of original digital data
- Some very high quality data, some poor quality
- Still large volume of hardcopy log data awaiting resources for digital capture
  - ~50% data available from BGS rest via release agents



RECALL Log Database



### Log Data quality and lifecycle



- Good log data has long lifespan
  - 50+ years
  - Iterative tool developments
- Industry data management is of highly variable quality
- Strong correlation between bad data management and bad data
- Unidentifable data has no value
- Careful log data management
  - saves time
  - adds value to bottom line
  - good for UK PLC



# Best and worst practise with UK well data management

- Most serious problem related to data storage
- One NHDA data parcel stored for years contained only mouldy pizza
- Digitising always degrades data
- Copying and archival of original tapes in source format ensures maximum data value
  - LIS/DLIS good : Allows acquisition parameters
  - LAS copy less good: essential metadata lost
  - Hand digitised: nearly useless
- BGS sometime holds 3 or 4 versions of the same data



# Best and worst practise with UK well data management



- Companies spend huge amounts of money collecting data and very little managing it
- Indexes essential for mapping well data to media
- Data lifespan is very prolonged
  - Future data value impossible to predict
  - Data end-uses cannot be foreseen
- Full metadata increases data usability and its value
- Metadata rich data is an asset not a liability



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Schlumberger Verification Listing

Listing Created: 4-MAY-2006 16:04:39 Version: 11C0-208

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Input Source: 0000074.all.tif Format: LIS LIS Origin: ARIC

#### Comment: SCHLUMBERGER WELL SERVICES CUSTOMER FLIC TAPE

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Field Name:	Sellafield				
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Well Data					
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Well Name	SELLAFIELD RCM1				
Field Name	Sellafield				
COUNTY:	KSW-26		CLAB, CC		
Nation	U.K.		Ν		
Field Location	Sellafield				
Longitude	E 305 568.3 M		LC		
Latitude	N 503 961.5 M		l		
Maximum Hole Deviation	0.0 (DEG)		Ν		
Elevation of Kelly Bushing	88.260 (M)		E		
Elevation of Ground Level	84.460 (M)		E		
Elevation of Derrick Floor	88.260 (M)		E		
Permanent Datum	Mean Sea Level	Elevation of Permanent Datum 0.0 (M)	PDAT, E		
Log Measured From	Rotary Table	Above Permanent Datum 88.260 (M)	LMF, A		
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Done

Param: Wsd

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## So why should industry care?

- Much data needed for decision making is lost/hidden/disregarded
  - Only a percentage is released rest has no path to end-users
- Well constrained data is an asset, not a liability
  - Can be resold
- Data held & served by BGS reduces risks, uncertainty and costs
  - Improved safety saves money and aids social acceptance
- North Sea increasingly being licensed from other activities
  - Seafloor geology for wind farms, pipelines, tidal-wave power
  - Licenced of deep aquifers for CCS likely



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# **NHDA Hutton Oilfield**



- NHDA-owned Hutton Field
- Located in UKCS Viking Graben
- 9km N-S by 3km E-W
- Discovery: 1973 by Conoco
- Original reserves: estimated at 550 MMBBL
- Production: 1984 2001
  - Decommissioned: 2002
- Can this be put to good use?



# Subsurface Teaching and Research Resource (STARR)

- Universities struggle to access high-quality data
- Students using very old data
- BGS providing Hutton data for:
  - BSc / MSc teaching
  - MSc / PhD research projects
- Dataset testing this summer
- Complete dataset available soon to all UK universities
- Aim to make this available to universities worldwide
- Contemplating release to industry for all training uses



#### STARR: Wells and seismic



- Test dataset includes:
- 1980s era 3D seismic shot covering 50 km<sup>2</sup>
- 7 vertical wells
  - Standard log suite
  - Velocity
  - Deviation
  - Stratigraphy data
- Full dataset : 64 wells
  - Full digital log datasets
  - VSP
  - Field reports etc etc



Sub-surfa

e teaching and research resource

#### STARR: now and next

- BGS has **unfunded** role in providing data for academic use
- STARR will ensure:
  - UK universities get access to high quality data
  - students will get better training
  - BGS can concentrate efforts to maximum effect
  - "UK PLC" gains more value from this data
  - Industry gains better trained graduates
- Future uses:
  - BGS considering release to any university globally
  - Could be extended to industry training use
  - Will require industry support and probably some funding





- The challenges of the future are complex and uncertain
- The subsurface will have a huge role in providing energy, managing environmental change and disposing of waste
- Costs will be high so prior knowledge is essential
- High quality data is vital for understanding the subsurface to meet such challenges