



PROFESSIONAL PETROLEUM DATA MANAGEMENT ASSOCIATION

Using Logical Decomposition to Simplify Complex Data

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WHY I'M TALKING ABOUT THIS SUBJECT

- ü Today's data professional handles a lot of data and information ...
 - § ... from many different sources...
 - § ... that may have been altered by someone else ...
 - § ... in mostly undocumented ways!

- ü It's helpful to think about the data logically and to question everything

- ü Research and clarity are important
 - § But it's hard work
 - § And it goes better if we do it together and share the results

EVEN THE WORDS WE USE TO MEAN STATUS ARE VAGUE!





WELL STATUS IS VERY USEFUL

- ü Well Status helps us to find wells
- ü They are used by every stakeholder to find wells that meet common criteria
- ü Most of the time, well status can be derived based on business rules
 - § But ONLY if you know what the business rules are!
- ü Once found, symbols based on status helps us to create meaningful maps and reports.



IHS COMPLETE WELL STATUS CODES

INTENDED TO BE VERY COMPLETE

<http://energy.ihs.com/NR/rdonlyres/2F43A1DD-2FB0-40C1-8C9A-1C5010F238EB/0/WellStatus.pdf>

1O&3G	1 OIL & 3 GAS WELL	1 OIL & 3 GAS WELL
1O&3GW	1 OIL & 3 GAS WELL WORKOVER	1O&3GW
1O&3WI	1 OIL & 3 WATER INJECTION WELL	1O&3WI
1O&4G	1 OIL & 4 GAS WELL	1 OIL & 4 GAS WELL
1O&4GW	1 OIL & 4 GAS WELL WORKOVER	1O&4GW
1O&5G	1 OIL & 5 GAS WELL	1 OIL & 5 GAS WELL
1O&5GW	1 OIL & 5 GAS WELL WORKOVER	1O&5GW
1O&6G	1 OIL & 6 GAS WELL	1 OIL & 6 GAS WELL
1O&7G	1 OIL & 7 GAS WELL	1 OIL & 7 GAS WELL
1O&9G	1 OIL & 9 GAS WELL	1 OIL & 9 GAS WELL
1I&1S	1 UNDESIGNATED INJECTION & 1 SERVICE WELL	1I&1S
1WI&1S	1 WATER INJECTION & 1 SERVICE WELL	1WI&1S
1WI1SW	1 WATER INJECTION & 1 SERVICE WELL WORKOVER	1WI1SW
1W1SOW	1 WATER INJECTION & 1 SERVICE WELL WORKOVER WITH OIL SHOWS	1W1SOW
1W1ISO	1 WATER INJECTION & 1 SERVICE WELL-OIL SHOWS	1W1ISO
2G&1S	2 GAS & 1 SERVICE WELL	2G&1S
2G&1WI	2 GAS & 1 WATER INJECTION WELL	2G&1WI
2G&2WI	2 GAS & 2 WATER INJECTION WELL	2G&2WI
2G&3WI	2 GAS & 3 WATER INJECTION WELL	2G&3WI
2GAS	2 GAS MULTIPLE PRODUCER	2GAS
2O1GW	2 OIL & 1 GAS INJECTION WELL WORKOVER	2O1GW
2O&1G	2 OIL & 1 GAS WELL	2 OIL & 1 GAS WELL
2O&1GW	2 OIL & 1 GAS WELL WORKOVER	2O&1GW
2O&1I	2 OIL & 1 INJECTION WELL	2O&1I
2O&1IW	2 OIL & 1 INJECTION WELL WORKOVER	2O&1IW
2O&1S	2 OIL & 1 SERVICE WELL	2O&1S
2O&1SW	2 OIL & 1 SERVICE WELL WORKOVER	2O&1SW
2O&1WI	2 OIL & 1 WATER INJECTION WELL	2O&1WI
2O1WIW	2 OIL & 1 WATER INJECTION WELL WORKOVER	2O1WIW
2O2GW	2 OIL & 2 GAS INJECTION WELL WORKOVER	2O2GW
2O&2G	2 OIL & 2 GAS WELL	2 OIL & 2 GAS WELL
2O&2GW	2 OIL & 2 GAS WELL WORKOVER	2O&2GW
2O&2WI	2 OIL & 2 WATER INJECTION WELL	2O&2WI
2O&3G	2 OIL & 3 GAS WELL	2 OIL & 3 GAS WELL
2O&3GW	2 OIL & 3 GAS WELL WORKOVER	2O&3GW
2O&3WI	2 OIL & 3 WATER INJECTION WELL	2O&3WI
2O&4G	2 OIL & 4 GAS WELL	2 OIL & 4 GAS WELL



WELL STATUS VALUES ARE VERY COMPLICATED!

Just 20 values reveals at least 9 kinds of information

Lots of information is IMPLICIT, rather than explicit!

How can business intelligence tools, including GIS, use this data most effectively?

The underlying rules used to derive are variable.

Life Cycle

Historical Information

Fluid Type

Non specific, unclear

Fluid Direction

Fluid Abundance

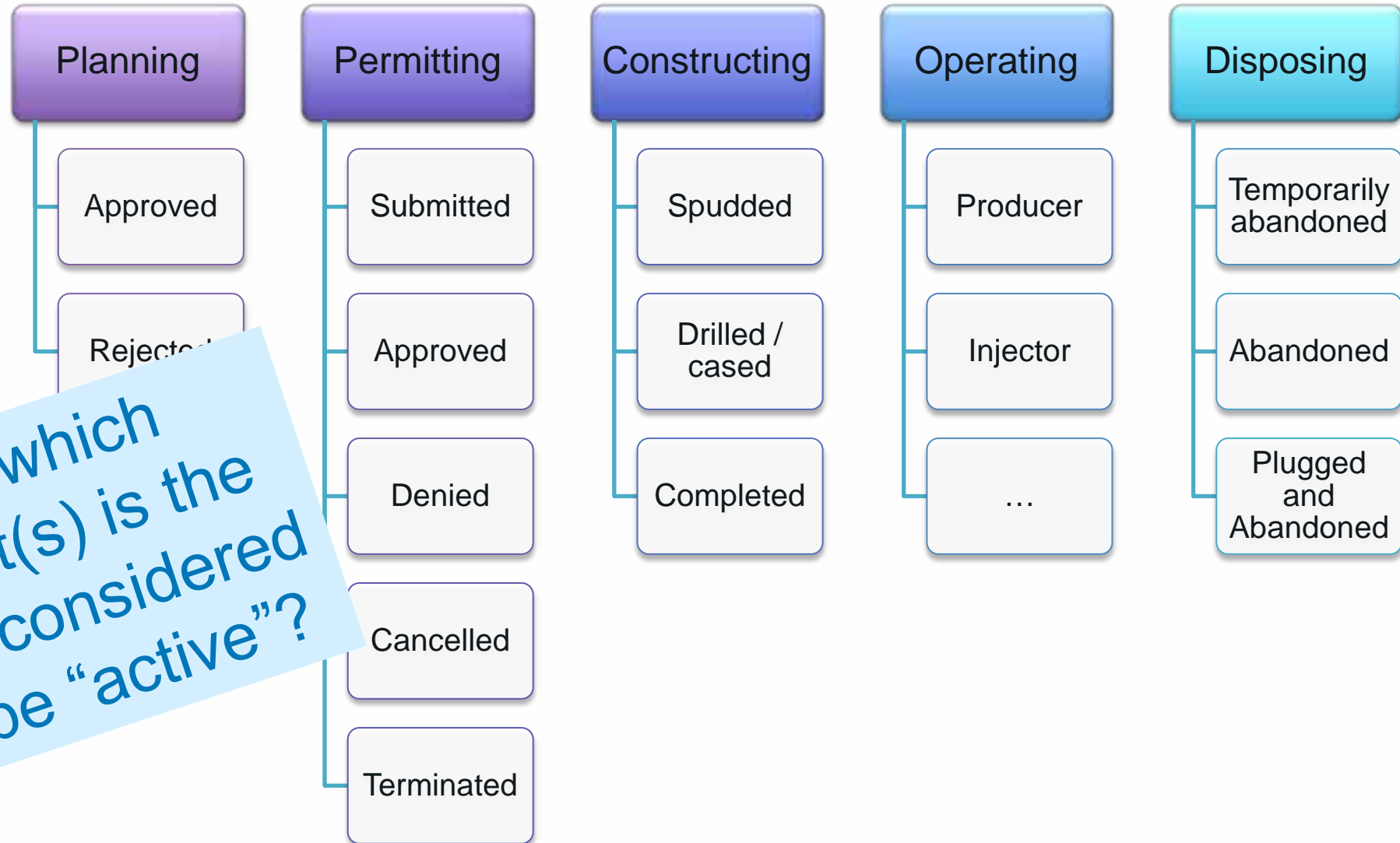
Field Work Status

Function

Regulatory Process

AB-LOC	ON
	ED METHAN
	NATION
	ODUCER
	ON W
	ODUCER
	WELL
	AIR INJECTION WELL
A-INJW	AIR INJECTIO
AI-G	AIR INJECTIO
	JECTIO
	JECTIO
	WELL
	ELLE
	ON
	ON DIOXIDE
	ON DIOXIDE PRODUCER
	ON DIOXIDE PRODUCER-GAS SHOWS

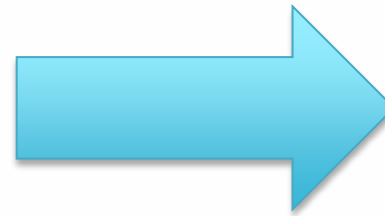
A “RELATIVELY” SIMPLE EXAMPLE



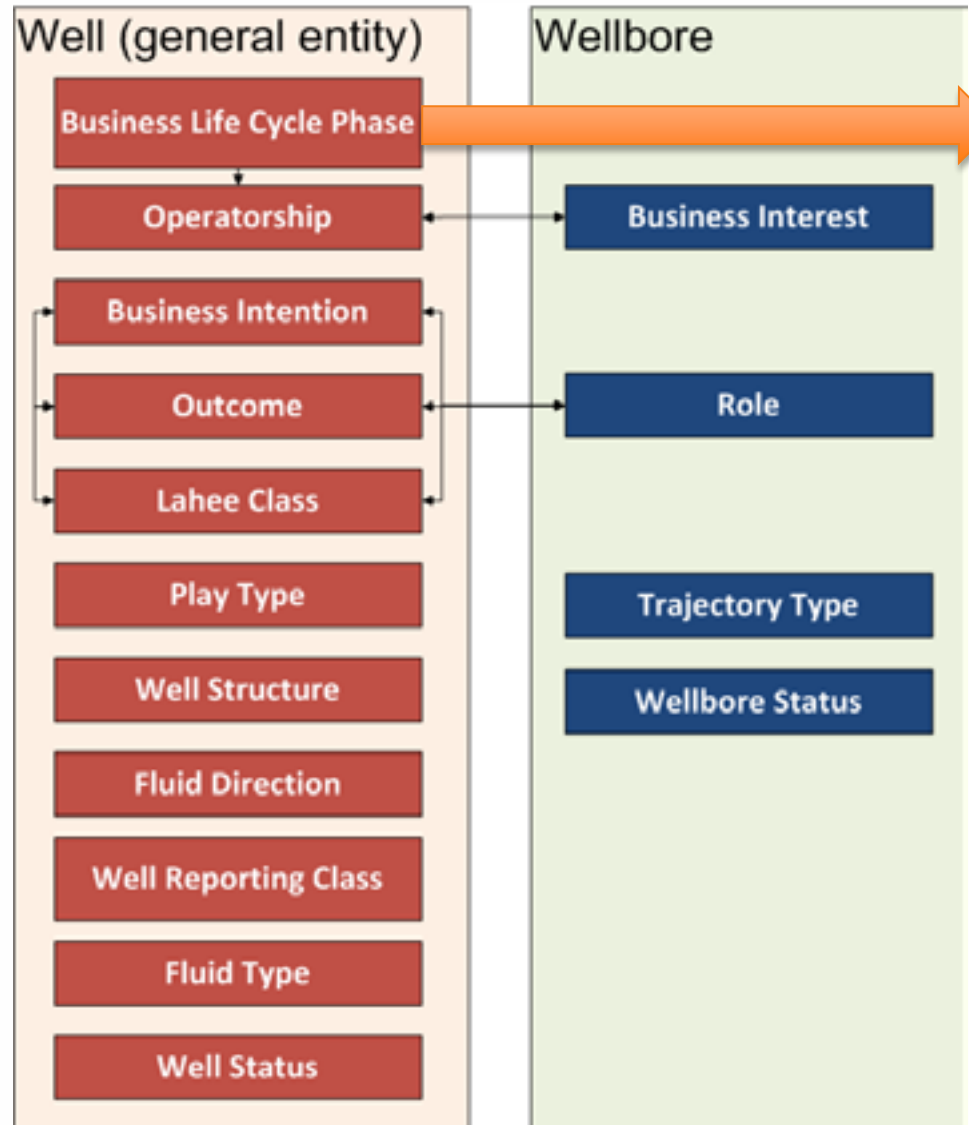
WHAT IS DECOMPOSITION?

Faceted taxonomies are designed to support this

- ü Find the embedded meaning
- ü Decompose into constituent semantics
- ü Name and define atomically.



15 KINDS OF INFORMATION HAVE BEEN IDENTIFIED AND DEFINED

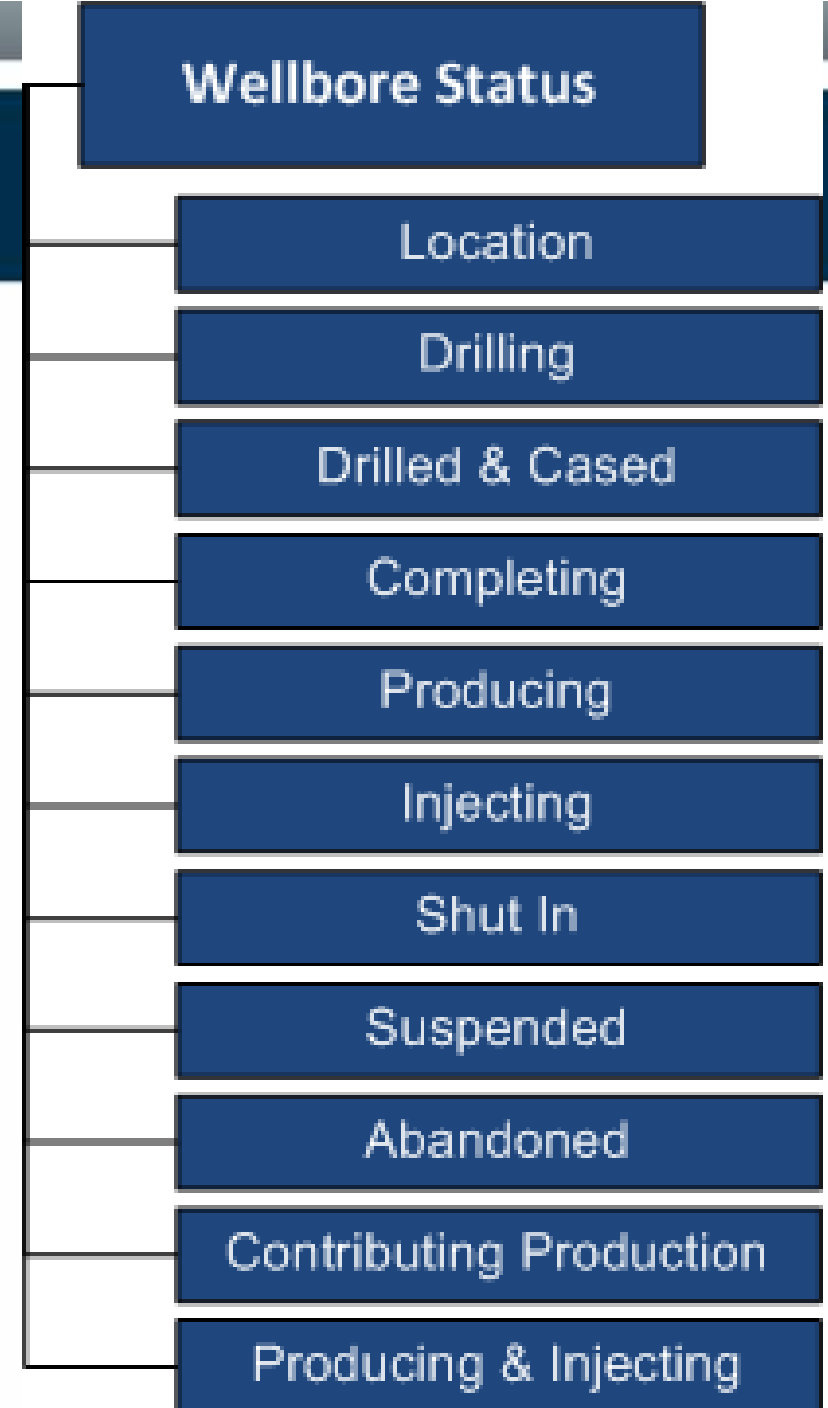
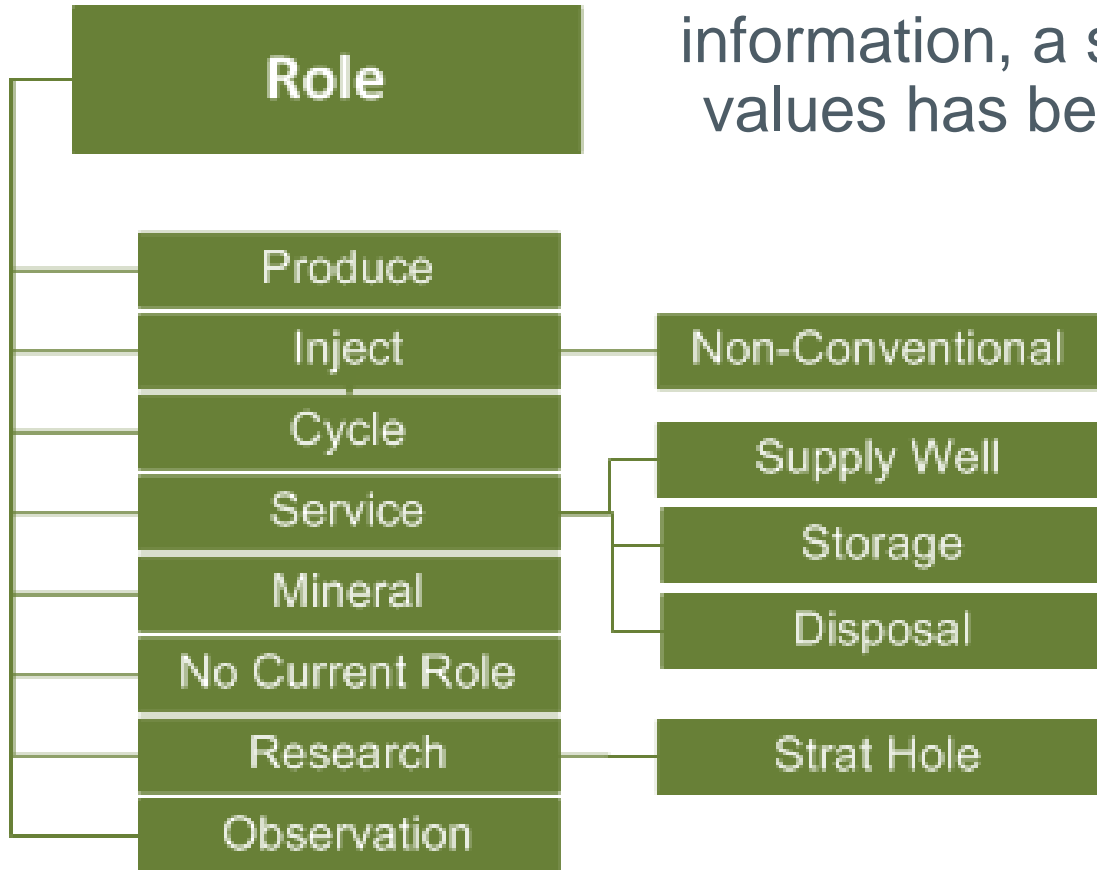


Business Life Cycle Phase is a collection of activities and conditions, that are grouped according to business significance, describing where an E&P asset (in this case a well) is at within its progressive history. Phases are related to business significance and are not related to time. Business Life Cycle Phase is relevant for wells that the E&P company has a Business Interest in. The value of the Business Life Cycle Phase is expected to change in a predictable manner as the well progresses through out its history and may reoccur as various operations are executed.



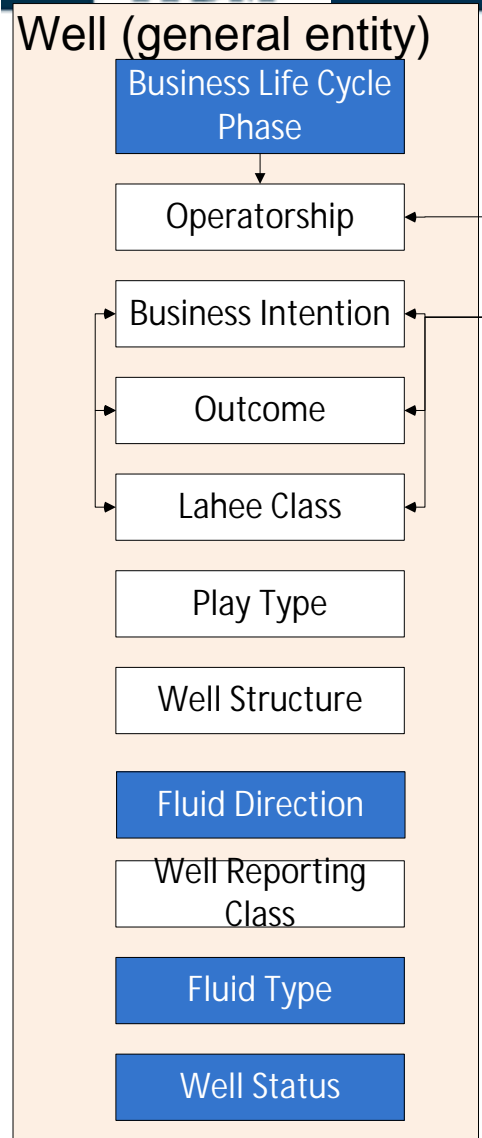
STARTER SETS OF VALUES

For each of the 15 kinds of information, a starter set of values has been created.





WELL STATUS: COMPLEX VALUES CAN BE DECOMPOSED



*ABANDONED
COMBINATION OIL &
GAS PRODUCER*

WellStatus.PPDM.org

Status Type	Status Value	Qualifier Type	Qualifier Value	Active?
Wellbore Status	Abandoned			Y
Fluid Type	Oil & Gas	Abundance	Primary	N
Role	Produce			N
Well Status	In-Active			Y
Fluid Direction	Static			Y



FACET DECOMPOSITION

Current Status Code	Current Status Name	Primary Fluid	Primary Role	Primary Fluid Abund	Secondary Fluid	Secondary Role	Secondary Fluid Abundance	Outcome	Wellbore Status
1G1WIW	1 GAS & 1 WATER INJECTION WELL WORKOVER	Gas	Produce	Commercial	Water	Inject		Success	Producing
1O&1GI	1 OIL & 1 GAS INJECTION WELL	Oil	Produce	Commercial	Gas	Inject		Success	Producing
2O&5G	2 OIL & 5 GAS	Oil & Gas	Produce	Commercial				Success	Producing
2O1GIW	2 OIL & 1 GAS INJECTION WELL WORKOVER	Oil	Produce	Commercial	Gas	Inject		Success	Producing
GAS	GAS PRODUCER	Gas	Produce	Commercial				Success	Producing
GI-OG	GAS INJECTION WELL-OIL & GAS SHOWS	Gas	Inject		Oil & Gas		Shows		Injecting
OIL	OIL PRODUCER	Oil	Produce	Commercial				Success	Producing
OSTWOG	OIL STORAGE WELL-OLD WELL WORKED OVER-OIL & GAS SHOWS	Oil	Storage		Oil & Gas		Shows		
SUS-OG	SUSPENDED WELL-OIL & GAS SHOWS		No Current Role		Oil & Gas		Shows	Unsuccessful	Suspended
WIWO	WATER INJECTION WELL-OLD WELL WORKED OVER-OIL SHOWS	Water	Inject		Oil		Shows		Injecting



HOW DOES IT WORK IN THE US? INTERNATIONALLY?

- ü Industry is using Well Status and Classification information to help create commonality between different regulatory datasets.

- ü Mapping and harmonizing the lists is difficult
 - § State lists are not all the same
 - § State lists may not be defined in regulations
 - § State lists have varying levels of granularity.

- ü If we want to make the mappings consistent, what do we need to do?

- ü Would regulators benefit from this Process?



PROCESS

ü Found representative data sets for

- § Well status
- § Well type
- § Product type
- § Permit status ...

ü Used a few regulatory areas

- § Texas, Ohio, New York, Louisiana, Colorado, Utah, Wyoming, Ontario, Michigan, Missouri

ü Compared what is in the datasets to what is in Well Status And Classification datasets



A LOT OF THE VALUES MAP VERY NICELY... IF YOU MAKE SOME ASSUMPTIONS!

State	CODES	FULL NAME	Business Life Cycle Phase	Lahee Class	Role	Fluid Direction	Well Reporting Class	Fluid Type	Abundance
TX RRC	B	Oil & Gas	Producing					Oil & Gas	
TX RRC	O	Oil	Producing		Produce			Oil	
NY DEC	IW	Enhanced Oil Recovery - Injection		Development	Inject	Inflow			
NY DEC	OD	Oil Development	Producing	Development	Produce	Outflow	Oil Well	Oil	Primary
NY DEC	OE	Oil Extension	Producing	Extension	Produce	Outflow	Oil Well	Oil	Primary
NY DEC	OW	Oil Wildcat	Producing	New-Pool Wildcat	Produce	Outflow	Oil Well	Oil	Primary
NY DEC	OW	Oil Well	Producing		Produce	Outflow	Oil Well	Oil	Primary
LA DNR	10	OIL	Producing		Produce	Outflow	Oil Well	Oil	Primary
Utah OGM	OW	Oil Well	Producing		Produce	Outflow	Oil Well	Oil	Primary
Wyoming GCC	PO	Producing Oil Well	Producing		Produce	Outflow	Oil Well	Oil	Primary



DISCOVERIES: SEMANTIC DIFFERENCES

ü What is an “Active” well?

ü What is a “Producing” well?

ü Abandoned vs. Plugged vs. P&A



DISCOVERIES: NEED TO INFER OR DERIVE

- ü Sometimes no consistent meaning can be reasonably inferred by a non-regulatory user without a lot of research.
 - § Makes queries difficult for users

- ü Sometimes the information is not contained in a coded “status”, but might be found elsewhere in filings
 - § Outcome à might be inferred
 - § Fluid direction à might be inferred
 - § Play type, well structure, trajectory are more difficult



DISCOVERIES: RELEVANCE TO STAKEHOLDERS

Regulators: Not Relevant

- Outcome
- Operatorship
- Business Intention
- Well Structure
- Business Interest
- Role

What most public users want

- ∅ Did that well get “constructed”?
- ∅ Is stuff coming out of or going into it?
- ∅ What is that stuff?

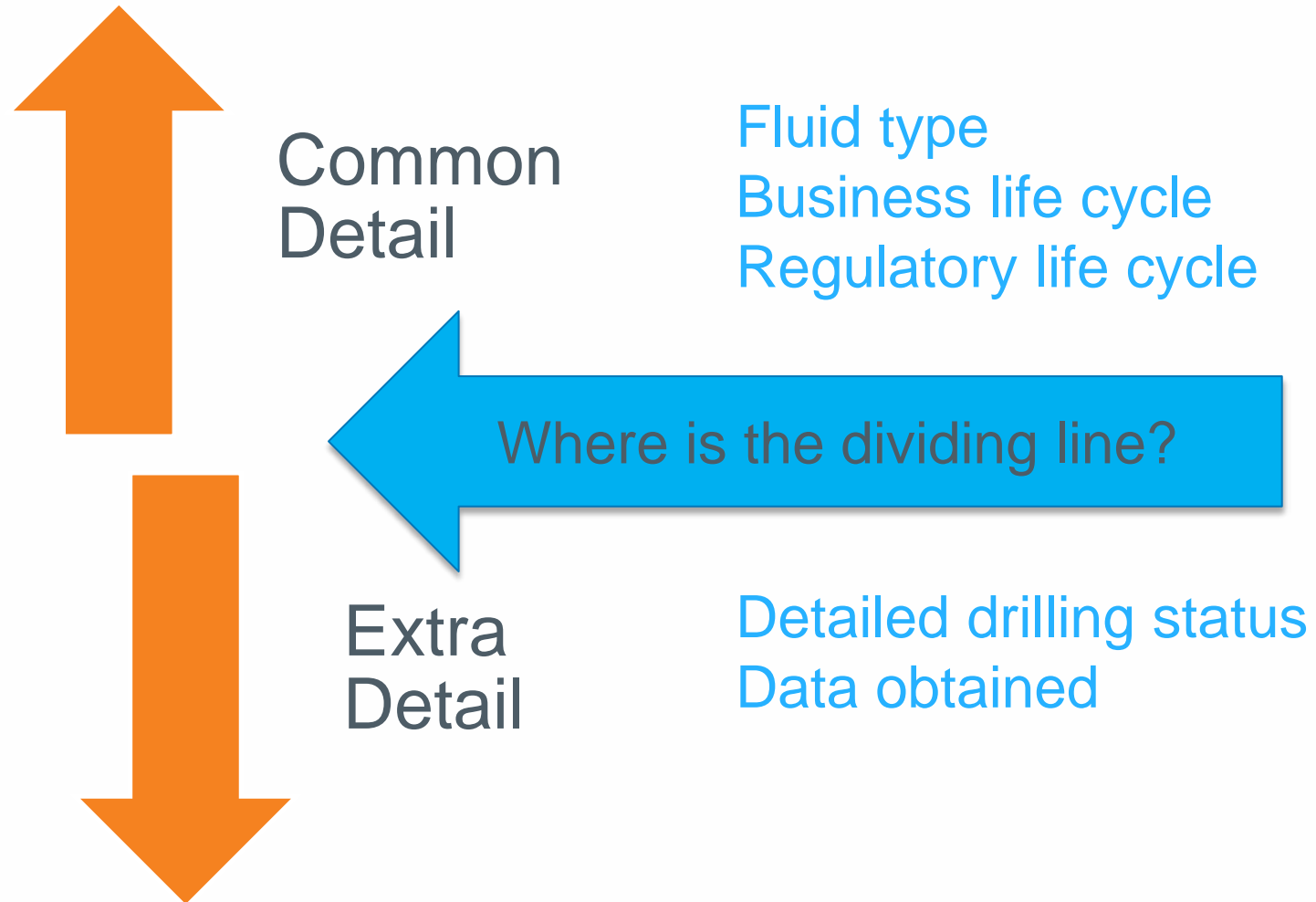
Regulators: Relevant

- Business Life Cycle Phase
- Lahee Class (rare)
- Fluid Type
- Fluid Direction
- Well Reporting Class (maybe)
- Well Status
- Wellbore Status (maybe)

Regulatory Objectives

- ∅ Are you following the rules?
- ∅ Is the reservoir managed?
- ∅ Are royalties due us?

DISCOVERIES: LEVEL OF DETAIL



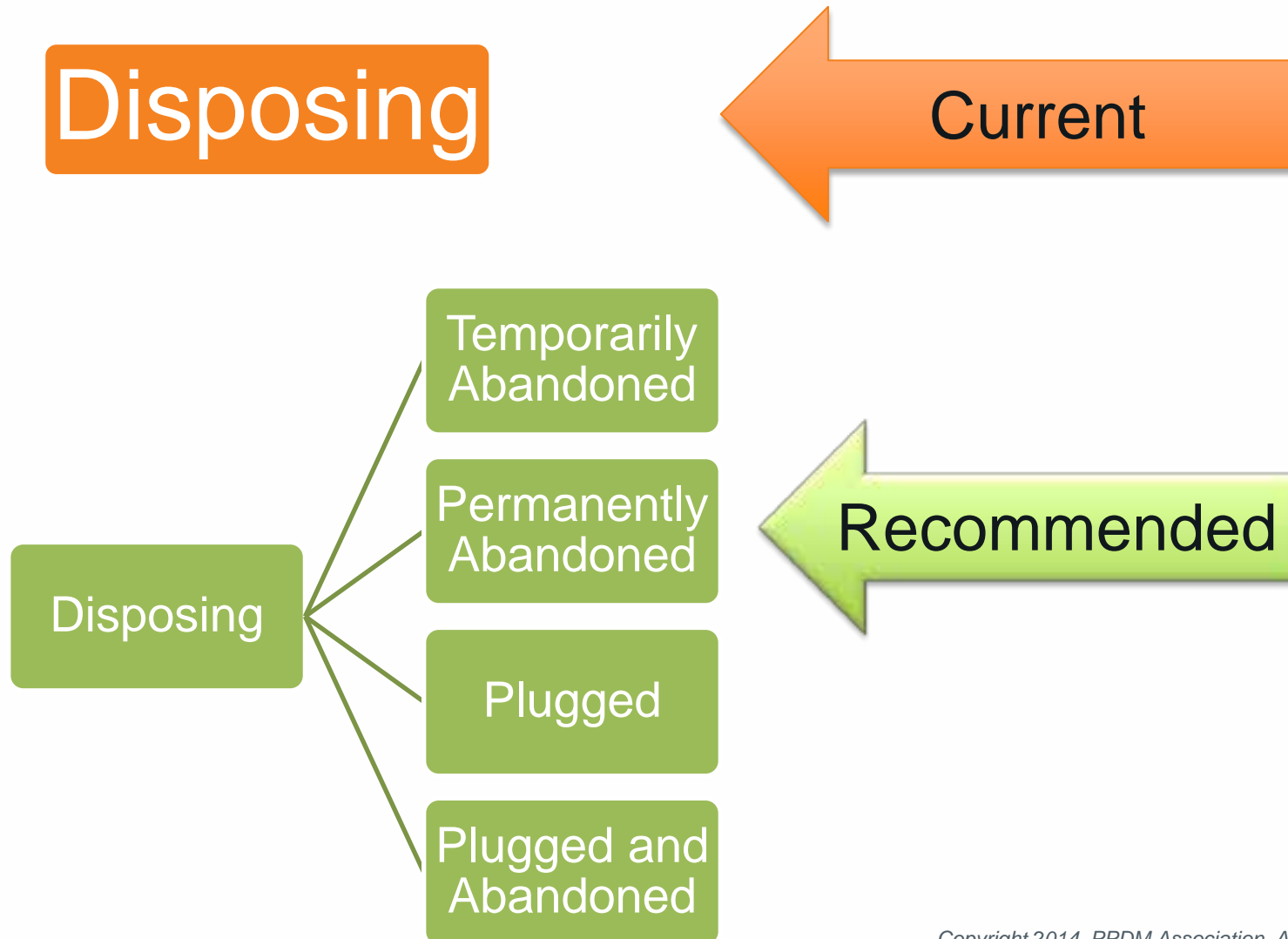


PLUG AND ABANDON

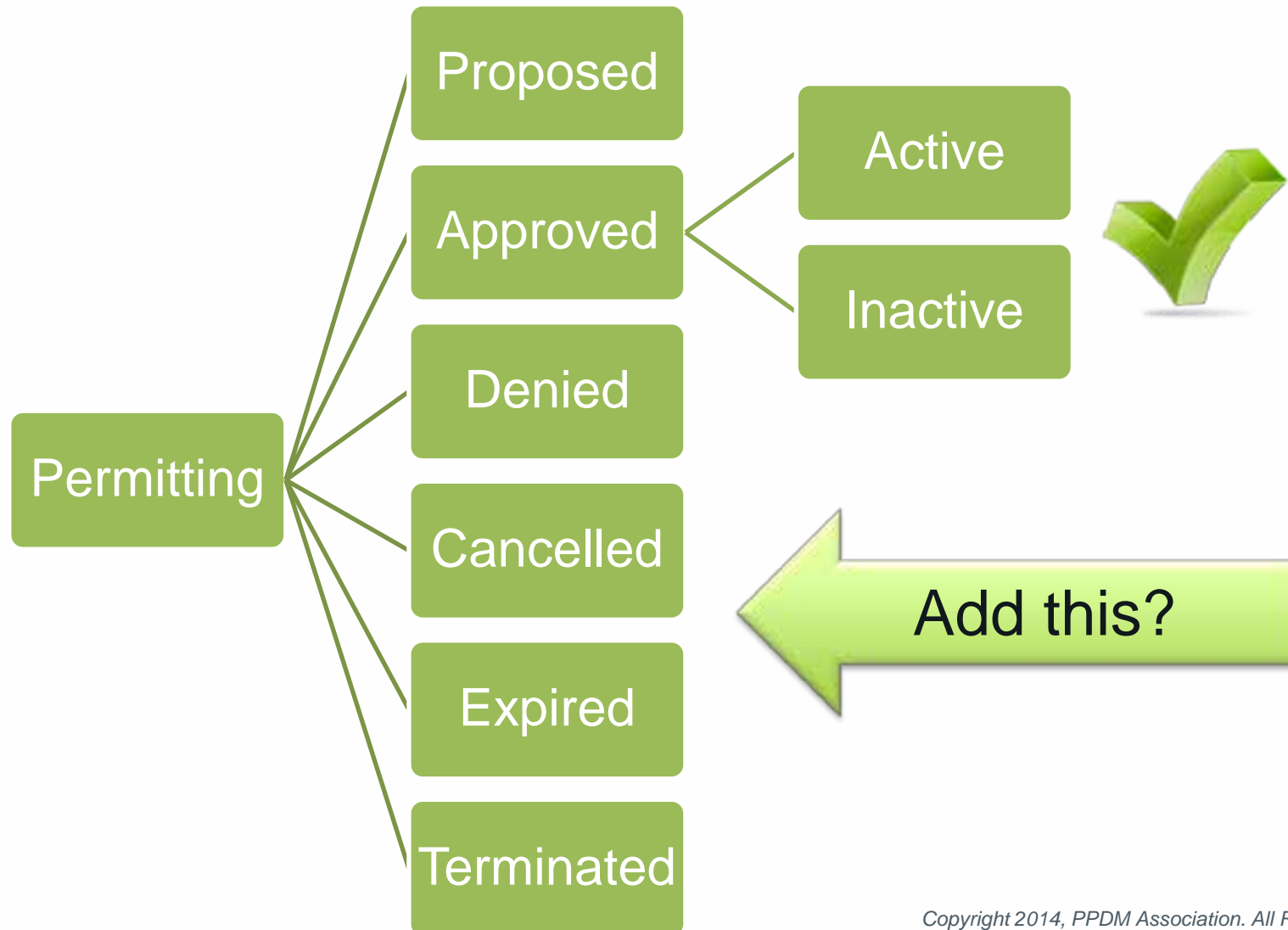
State	CODES	FULL NAME
NY DEC	AR	Application Received to Drill/Plug/Convert
NY DEC	PA	Plugged and Abandoned
NY DEC	PM	Plugged Back Multilateral
NY DEC	TA	Temporarily Abandoned
NY DEC	AB	Abandoned Location
NY DEC	GWP	Gas Well Plugged
NY DEC	OWP	Oil Well Plugged
NY DEC	SP	Storage Well Plugged
NY DEC	SMP	Solution Brine Well
NY DEC	OP	Other Well Plugged
LA DNR	18	TEMPORARILY ABANDONED WELL
LA DNR	27	ABANDONED SWD - NOT PLUGGED
LA DNR	28	UNABLE TO LOCATE WELL-NO PLUGGED AND ABANDONED
LA DNR	29	DRY AND PLUGGED
LA DNR	30	PLUGGED AND ABANDONED
LA DNR	35	PLUGGED BACK - NO PERFORATIONS - NO LUW
CO GCC	AB	ABANDONED WELL
CO GCC	AL	ABANDONED LOCATION
CO GCC	DA	DRY AND ABANDONED
CO GCC	PA	PLUGGED AND ABANDONED
CO GCC	TA	TEMPORARILY ABANDONED
Utah OGM	TA	Temporarily-abandoned
Utah OGM	PA	Plugged & Abandoned
Utah OGM	LA	Location Abandoned
Wyoming	TA	Temporarily Abandoned
Wyoming	PA	Permanently Abandoned
Wyoming	NI	Notice of Intent to Abandon
Wyoming	SR	Subsequent Report of Abandonment
Wyoming	TA	Temporarily Abandoned
Wyoming	PA	Permanently Abandoned
TX RRC	D	Plug Dry Hole -- Plugged and Abandoned (W-3)
TX RRC	H	Plug Dry Hole -- Plugged and Abandoned Letter
TX RRC		Plugged and Abandoned Sulphur Core Test
TX RRC		Plug Back
TX RRC		Test (Plugged and Abandoned)
TX RRC		(oil)
TX RRC		
TX RRC	R	
TX RRC	S	Plug Dry Hole
TX RRC	V	Plug Uranium
TX RRC	X	Lignite Exploration
TX RRC	D	Dry Hole -- Plugged and Abandoned
TX RRC	T	Plugged and Abandoned Exploration

Lots of additional information. What should we do with it?

- Operator processes
- Data obtained
- Fluids or substances identified
- Regulatory processes or reports
- Well outcome
- Well type or purpose
- Well configuration
- Time (temporary, permanent)



NEW FACET LIFE CYCLE: PERMITTING





SUMMARY

- ü A savvy users knows that nothing can be assumed
- ü It's best to go back to the trusted authority if you can
- ü Working together to sort out these problems is better
- ü There is value to everyone if we can begin to converge in practice!



PROFESSIONAL PETROLEUM DATA MANAGEMENT ASSOCIATION

Just a taste of what is needed
Thanks for your input!

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