# Maximizing the Value of Your Data: From Field Data Collection to Validation, Storage, Updates, and Analysis

Ashley Gorham – BP America Production Company
Josh Pendleton – Dynamic Risk Assessment Systems
Tuesday, June 9<sup>th</sup>, 2009



#### In the next 30 minutes...

- Goal of presentation
- The problem
- Challenges associated with typical processes
- Case study of data cycle
- What was BP able to do to address and solve some of these challenges



### The Problem...



**Data Collection** 



Program Development



**Knowledge Sharing** 





**Analysis** 



**Execution & Activity** Tracking



**Local Storage** 



Reporting



#### **Challenges**

- Lack of constraints for field collected data
- Unclear workflow/data collection techniques (no metadata)
- Increasing volume of data being collected
- Insufficient staff to complete required validation



#### Non-Standardized data examples:

Photo of Wellsite with hand written note, and a black steer



• Handwritten CP survey form scanned as a .pdf

Rectifier Data											
Mile Post, Coordinates or Other Identifier Dunagan "A" # 1	Unit number R - 04										
Name Universal Rectifiers		Model number AAP	Serial number 900560								

Bimonthly Rectifier Inspection (6 times each calendar year not to exceed 2-1/2 months)

			DC	Output					
Date	Inspected By:	Rectifi	ier Meter		e Meter	Remarks			
		Volts	Amps	Volts	Amps				
1-10-28	K Moura	28.0	1.5	26.75	1.268				
3-5-08	K. Mourt	2.8.0	1.6	26,6	1, 236				
5.11	Killyoung	28.0	1.5	26,83	1.256	2 F 2 7			
7-17	K. M ome	32.0	1.75	37, 82	1.916	3 2			
9-10	Kimon	37.0	1.75	37.72	1, 908				
11-14	K'mour	37,0	2,0	37,82	1. 904				

Annual Rectifier and Ground Bed Inspection (Once each calendar year not to exceed 15 months)

Date of Inspection:	Inspe	ected By:				
			Rectifier Data			
Maximum DC Volts		Maximum DC Amp		A	C Voltage	
Transformer Taps:	As found:	Course	Fine	Adjusted To:	Course	Fine

#### Extract from proprietary CP survey database

TEST					PIP					
AREA	DATE	LOCATION	STRUCTURE	POINT	On	1/0	CASING	REMARKS		
3.00	11/29/2007	Cummins Fed. Road	M. TS	White wire	-1.129					
3.00	11/29/2007	Cummins Fed. Road	S. TS	Black wire	-1.046					
3.00	11/29/2007	Cummins Fed. Road	S. TS	White wire	-1.046					
4.00	11/29/2007	R.O.W.	Cummins Lateral	Riser	-1.152					
4.00	11/29/2007	R.O.W.	505 B-1 Lateral	Riser	-1.128					
5.00	11/29/2007	R.O.W.	Lateral Riser	TS	-1.185					
5.00	11/29/2007	R.O.W.	2" fuel gas	Riser	-1.113					
5.00	11/29/2007	R.O.W.	W. TS	Black wire				TEST LEADS GONE.		
5.00	11/29/2007	R.O.W.	W. TS	White wire				TEST LEADS GONE.		
5.00	11/29/2007	R.O.W.	M. TS	Black wire	-1.173					
5.00	11/29/2007	R.O.W.	M. TS	White wire	-1.131					
5.00	11/29/2007	R.O.W.	E. TS	Black wire	-1.198					
5.00	11/29/2007	R.O.W.	E. TS	White wire	-1.132					
6.00	11/29/2007	457 E-1 Road Crossing	W. TS	Blue wire				Lead is to far down the conduit.		
6.00	11/29/2007	457 E-1 Road Crossing	W. TS	Black wire				Lead is to far down the conduit.		
6.00	11/29/2007	457 E-1 Road Crossing	W.TS	White wire				Lead is to far down conduit		
6.00	11/29/2007	457 E-1 Road Crossing	E. TS	Red wire	000			BAD WIRE		
6.00	11/29/2007	457 E-1 Road Crossing	E. TS	Black wire	358					

Tuesday, December 11, 2007 Page 2 of 10



#### Spreadsheet from CP survey (no spatial data or unique ID)

SUMMARY OF RECOMMENDATIONS												
READING NO.	PROBLEM	RECOMMENDATION	STATUS	PRIORITY CODE								
2.100	FIK electrically "shorted"	Replace "shorted" 6", 600# flange ins. kit - "flagged"	Pending	1								
153.000	"Open" negative cable	Troubleshoot "open" negative & repair as needed	Pending	2								
172.000	"Low" P/S; PL lateral electrically "shorted" be new corral	Excavate PL @ corral post; Visually inspect and repair as needed	Pending	1								
179.000	"Low" P/S - Possible CP interference	Contact Centerpoint CP Tech & conduct joint CP interference tests	Pending	1								
	Needs more information	Need to obtain allignment sheets of this location	Pending	3								



Spreadsheet from CP survey (different format, not unique, not spatial)

	Q39		<b>→</b> (0	$f_x$	No	)													
	Α	В	С	D	Е	F	G	Н	1	J	K	L	M	N	0	Р	Q	R	
																		Other	
1	Area	Meter#	Well Name	Sec	Twn	Rng	JHA	RECT	VOLTS	AMPS	GB RESIS	WH P/S	MH P/S	ADJ	DATE	TECH	Sys ok	/Mate	COMMENTS
2	San Juan		A L ELLIOT	11	29	9	Yes	s12-4	8.2	2.7	3.03	0.873	.890/.909	no	11/04/2007	bb	Yes	No	
3	San Juan		A L ELLIOT		29	9	Yes	s8-6	6.3	4.2	0.984	0.953	1.190/1.080	no	03/02/2007	bb	Yes	No	
4	San Juan		A L ELLIOT	10	29	9	Yes	s8-6	6.3	2.2	0.984	1.04	1.180/1.162	no	03/02/2007	bb	Yes	No	
5	San Juan		A L ELLIOT	12	29	9	Yes	s6-6	10.1	3.1	3.04	1.16	1.032/1.192	no	05/02/2007	bb	Yes	No	
6	San Juan		A L ELLIOT	12	29	9	Yes	s6-6	10.1	1.6	2.66	0.973	1.001/1.104	no	05/02/2007	bb	Yes	No	
7	San Juan		A L ELLIOT	13	29	9	Yes	s12-15	13.1			0.82	.819/.905	yes	09/03/2007	bb	Yes	No	
8	San Juan		A L ELLIOT	14	29	9	Yes	s12-4	6.5	3.3		0.872	.870/.949	no	10/03/2007	ar	Yes	No	
9	San Juan		A.L ELLIOT	10	29	9	Yes	s12-4	5.2	3.2	1.62	0.863	.969/.860	no	11/04/2007	bb	Yes	No	
10	San Juan		A.L. ELLIOT	10	29	9	Yes	r24-16	6.2			1.009	1.246/1.314	no	03/02/2007	bb	Yes	No	
11	San Juan		A.L.ELLIOT	11	29	9	Yes	s6-10	3.8	3	0.66	0.9	1.045/1.260	no	05/02/2007	bb	Yes	No	
12	GCU		ALLEN A 1E	1	29	12	Yes	28-16	5.5	4.2	1.31	1.025	1.065/1.260	no	24/01/2007	bb	Yes	No	
13	San Juan		ANNIE L EL	11	29	9	Yes	s6-10	3.8	2.8	0.66	0.945	1.017/1.245	no	05/02/2007	bb	Yes	No	
14	San Juan		ANNIE L EL	13	29	9	Yes	s12-15	13.1	3.1	1.22	0.863	.910/.943	yes	09/03/2007	bb	Yes	No	
15	Animas		ARCHULETA	30	30	8	Yes	s6-6	8.3	2.8	2.96	1.158	1.394/1.511	no	08/02/2007	bb	Yes	No	
16	Animas		ARCHULETA	19	30	8	Yes	s6-6	7.1	3.3	1.5	0.996	1.150/1.231	no	21/03/2007	ar	Yes	No	
17	Animas		ARCHULETA	19	30	8	Yes	s 6-6	7.1	1.6	1.5	1.097	1.217/1.297	no	21/03/2007	ar	Yes	No	
18	San Juan		ARCHULETA	5	29	9	Yes	r40-25	10.9	3.1	1.16	1.119	1.213/1.301	no	08/02/2007	bb	Yes	No	
19	San Juan		ARCHULETA	5	29	9	Yes	r40-25	16.4	4.4	9.65	1.091	1.206/1.352	no	08/02/2007	bb	Yes	No	
20	San Juan		ARCHULETA	5	29	9	Yes	r40-25	16.4	4.2	9.65	1.125	1.116/1.273	no	08/02/2007	bb	Yes	No	
21	San Juan		ARCHULETA	5	29	9	Yes	r40-25	10.9	4	1.16	0.986	.956/1.222	no	08/02/2007	bb	Yes	No	
22	San Juan		ARCHULETA	5	29	9	Yes	r40-25	16.4	3.1	9.65	1.019	1.013/1.126	no	08/02/2007	bb	Yes	No	
23	San Juan		ARCHULETA	5	29	9	Yes	r40-25	10.9	2.3	1.16	1.089	.860/.969	no	08/02/2007	bb	Yes	No	
24	Animas		ATLANTIC 1	34	31	10	Yes	r40-16	10.8	3.3	1.3	1.113	1.259/1.529	no	21/02/2007	ar	Yes	No	
25	Animas		ATLANTIC 1	34	31	10	Yes	r40-16	10.8	2.5	1.3	0 904	1 070/1 079	no	21/02/2007	ar	Yes	Nο	



Case Study - Annual CP Survey

Field data collection

Validation/Post-processing

- Delivery to operator
- Integration/Storage
- Analysis and reporting
- Repairs/Remediation







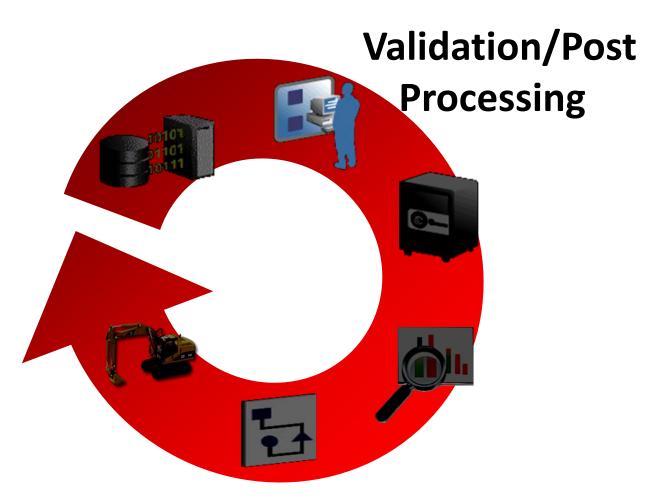


### **Case Study – Data Collection**



- Data collected in field over number of weeks
- Large amounts of data delivered to Operator from CP survey

	Q39		<b>v</b> (9	$f_{x}$	No	)													
	Α	В	С	D	Е	F	G	Н	1	J	K	L	M	N	0	Р	Q	R	
																		Other	
1	Area	Meter#	Well Name		Twn	Rng					GB RESIS		MH P/S	ADJ			Sys ok	/Mate	COMMENTS
2	San Juan		A L ELLIOT		29			s12-4	8.2	2.7	3.03		.890/.909	no	11/04/2007			No	
3	San Juan		A L ELLIOT		29			s8-6	6.3	4.2			1.190/1.080	no	03/02/2007			No	
4	San Juan		A L ELLIOT	10	29	9	Yes	s8-6	6.3	2.2	0.984	1.04	1.180/1.162	no	03/02/2007	bb	Yes	No	
5	San Juan		A L ELLIOT	12	29	9	Yes	s6-6	10.1	3.1	3.04	1.16	1.032/1.192	no	05/02/2007	bb	Yes	No	
6	San Juan		A L ELLIOT	12	29	9	Yes	s6-6	10.1	1.6			1.001/1.104	no	05/02/2007	bb	Yes	No	
7	San Juan		A L ELLIOT		29			s12-15	13.1	2.8	1.22		.819/.905	yes	09/03/2007			No	
8	San Juan		A L ELLIOT		29	9	Yes	s12-4	6.5	3.3	1.97		.870/.949	no	10/03/2007	ar	Yes	No	
9	San Juan		A.L ELLIOT	10	29	9	Yes	s12-4	5.2	3.2	1.62	0.863	.969/.860	no	11/04/2007	bb	Yes	No	
10	San Juan		A.L. ELLIOT	10	29	9	Yes	r24-16	6.2		0.873	1.009	1.246/1.314	no	03/02/2007	bb	Yes	No	
11	San Juan		A.L.ELLIOT	11	29	9	Yes	s6-10	3.8	3	0.66	0.9	1.045/1.260	no	05/02/2007	bb	Yes	No	
12	GCU		ALLEN A 1E	- 1	29	12	Yes	28-16	5.5	4.2	1.31	1.025	1.065/1.260	no	24/01/2007	bb	Yes	No	
13	San Juan		ANNIE L EL	11	29	9	Yes	s6-10	3.8	2.8	0.66	0.945	1.017/1.245	no	05/02/2007	bb	Yes	No	
14	San Juan		ANNIE L EL	13	29	9	Yes	s12-15	13.1	3.1	1.22	0.863	.910/.943	yes	09/03/2007	bb	Yes	No	
15	Animas		ARCHULETA	30	30	8	Yes	s6-6	8.3	2.8	2.96	1.158	1.394/1.511	no	08/02/2007	bb	Yes	No	
16	Animas		ARCHULETA	19	30	8	Yes	s6-6	7.1	3.3	1.5	0.996	1.150/1.231	no	21/03/2007	ar	Yes	No	
17	Animas		ARCHULETA	19	30	8	Yes	s 6-6	7.1	1.6	1.5	1.097	1.217/1.297	no	21/03/2007	ar	Yes	No	
18	San Juan		ARCHULETA	5	29	9	Yes	r40-25	10.9	3.1	1.16	1.119	1.213/1.301	no	08/02/2007	bb	Yes	No	
19	San Juan		ARCHULETA	5	29	9	Yes	r40-25	16.4	4.4	9.65	1.091	1.206/1.352	no	08/02/2007	bb	Yes	No	
20	San Juan		ARCHULETA	5	29	9	Yes	r40-25	16.4	4.2	9.65	1.125	1.116/1.273	no	08/02/2007	bb	Yes	No	
21	San Juan		ARCHULETA	5	29	9	Yes	r40-25	10.9	4	1.16	0.986	.956/1.222	no	08/02/2007	bb	Yes	No	
22	San Juan		ARCHULETA	5	29	9	Yes	r40-25	16.4	3.1	9.65	1.019	1.013/1.126	no	08/02/2007	bb	Yes	No	
23	San Juan		ARCHULETA	- 5	29	9	Yes	r40-25	10.9	2.3	1.16	1.089	.860/.969	no	08/02/2007	bb	Yes	No	
24	Animas		ATLANTIC 1	34	31	10	Yes	r40-16	10.8	3.3	1.3	1.113	1.259/1.529	no	21/02/2007	ar	Yes	No	
	Animas		ATLANTIC 1	34	31	10	Yes	r40-16	10.8	2.5	1.3	0 904	1 070/1 079	no	21/02/2007	ar	Yes	No	

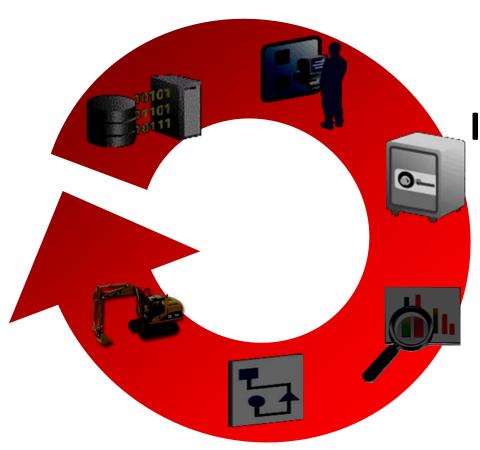




### **Case Study – Validation/Post Processing**

- Operator has to review incoming data to validate format, completeness and readings
- Validation process typically requires manual manipulation of received data which is time consuming
- Validation identifies records with incorrect readings or missed equipment readings





Integration and Storage



### **Case Study – Integration and Storage**



- Typically survey data will be stored on one machine and is not available for sharing across groups
- Native format may change from survey to survey/year to year and can be difficult to compare results
- Difficult to share information across groups



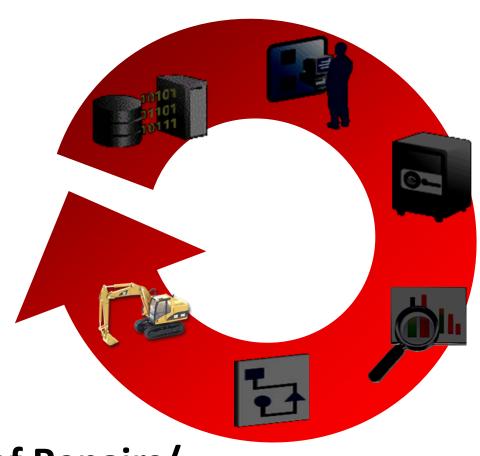




### **Case Study – Analysis and Reporting**

- By the time data validation is complete the field crew has moved on or is busy with other projects
- Updating with new readings can take months
- Re-mobilizing/deploying can cost more
- Any required reports cannot be issued until dataset is validated and complete





Execution of Repairs/ Remediation



### Case Study – Execution of Repairs/Remediation

Field repair and remediation programs are executed





### Case Study – Identified Challenges Summary

- Non-standardized data collection
- Multiple vendors/field staff collecting data
- Analysis of data is delayed
- Inefficient workflows



#### **Case Study – Solution**

- Data Collection: template driven data collection
- Validation: programmatic
- Integration and Storage: centralized
- Analysis and Reporting: defendable
- Repairs/Remediation: consistent
- Execution: efficient



#### **Case Study – Solution – Template**

													<u>00</u>
	Location	Stri On	Off	For On	eign Off	Bond Current	License	Reading Comments	Structure Type	Deficiency	Owner	Operator	Shared
LineName Structure Description			Oπ	On	Oπ	Current							ď
30719-28-1	Wells (3)	1614	1229	843	888		30719-28	Kit tested okay. Foreign = 8-9,9-9, and 102/2-9 wells	Well				
30719-73-1	Wells (4)	1097	996	757	757		30719-73	Common flowline	Well				П
30719-70-1	Wells (5)	1110	1015	768	771		30719-70	2 flowlines Isolate piping from both support pilings	Well				П
2973-89-1	Wells 102/14-14 and 102/12-14	970	915	717	717		2973-89	Common flowline	Well				П
	Wells 15-17 and 7-20	1530	1111	810	828			Isolation effective; 0 mA	Well				П
30719-71-1	Wells 3-11/12-11	1047	958	743	743		30719-71	3 flowlines, includes flowline from separator	Well				
30719-75-1	Wells 7-14, 16-11, 3-14 and 5-13	980	915	761	761		30719-75	2 flowlines	Well				П
6482-5-1	West F/L/Well (Gas)	1183	1145	857	857		6482-5		Well				П
30719-14-1	Booster Comp	1530	1118				30719-14	Compressor on wooden skids	Compressor				П
	Compressor and Separator			609	604			Shorted 10 mA via cladding to compressor. No remedial req'd	Compressor				
	Compressor/ Separator			1613	1121			All above-ground pipe	Compressor				
30719-12-1	Line at Tank	1313	1184				30719-12	To Header	Storage Tank				П
	Line W. of Tank	1164	1164					To Husky 10-32. Protected by Husky	Storage Tank				
30719-32-1	Lines E. of Tank (3 F/Ls)	1164	1164				30719-32		Storage Tank				П
	Pop Tank							N/R - tank removed	Storage Tank				П
34410-1-1	•		758	821	821		34410-1		Water Injection				

### **Case Study – Solution – Validation**



- Data can be programmatically validated in the field prior to submission to operator
- Identify errors early and addressed quickly
- Field data validated before submission to operator

#### **Case Study – Solution – Integration and Storage**

- Standardized data format allows for storage in a database
- Programmatic load to database to ensure referential integrity maintained



- Centrally located data available to more users
- Centrally located data provides reference and support for activities and planning



#### Case Study - Solution - Analysis and Reporting

 Central database allows for many users to access and use data



- Central database allows for data to become part of the "Whole Picture" of a pipeline asset
- Analysis and reports are defendable, repeatable and consistent





### **Case Study – Solution – Repairs/Remediation**

- Work plans can be created using validated and organized datasets
- Work plans can rely on historical data to provide context and reference for updated field data collection activities
- Work plans are consistent and repeatable



### **Case Study – Solution – Execution**



- Properly planned work programs are efficient, cost effective and consistent
- Tools provided for execution stage will ensure the cycle will continually improve
- Data collection is more easily managed with reliance on standardized requirements, formats and deliverables



#### **BP NAG Kit Make-Up**

- Heritage companies: Amoco, Arco, Vastar, BP, other regional independents
- ~14,000 wellsites
- ~9,500 miles of pipe
- ~12 gas plants
- 13 Operating Centers across 8 States each with their own data sources and procedures



### **BP Pipeline Risk Model Project**

- Began developing pipeline risk model in 2005
- Spent 2 years on data collection and validation
  - SME interviews
  - 3<sup>rd</sup> party geospatial data collection projects
  - Outside operated production
  - Failure history
  - Inspection data
  - Corrosion control and monitoring data

And we faced some challenges!



#### Data Challenges Expressed at GeoGathering

- "70% of engineering time spent on gathering and validating data"
- "Data is managed in different silos"
- "Problems with data integrations because of formats and naming convention"
- Inaccuracies of data



#### **BP Pipeline Risk Model Project – Challenges**

- No standardized naming convention
  - Post validation updates were a challenge due to non-unique IDs
- Multiple disconnected data sources (op. center to op. center – not centralized)
- Loss of institutional knowledge



### **BP Reality**

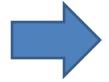
- Data collection and validation inefficiencies lead to increased time and spend which often delivered risk results that were suspect
- Ultimately didn't translate to improved system reliability at maximized cost efficiencies



External Data Sources -Data Collection Templates

Pipeline Model

Production Database Extract



Well Integrity Model

Failure Tracking Database



Facilities RBI Model





#### **BP Solution**

- Life cycle data management collection through to reporting
- Standardized data updating process
- User based (roles) edit controls
- Map-centric user interface with the database
- Meet business needs for multiple stakeholders
  - DOT compliance, corporate risk tolerance, etc.



#### **BP Benefits**

- Leverage existing practices to create and maintain data
- Efficiency gains through automated data validation
- Shared access to integrity information by all stakeholders
- Integrated data sets ensure robust, defendable, and repeatable decisions
- Improved system reliability results in greater deliverability and increased cash flow

#### **BP Value**



