

AGING INFRASTRUCTURE & ASSET MANAGEMENT

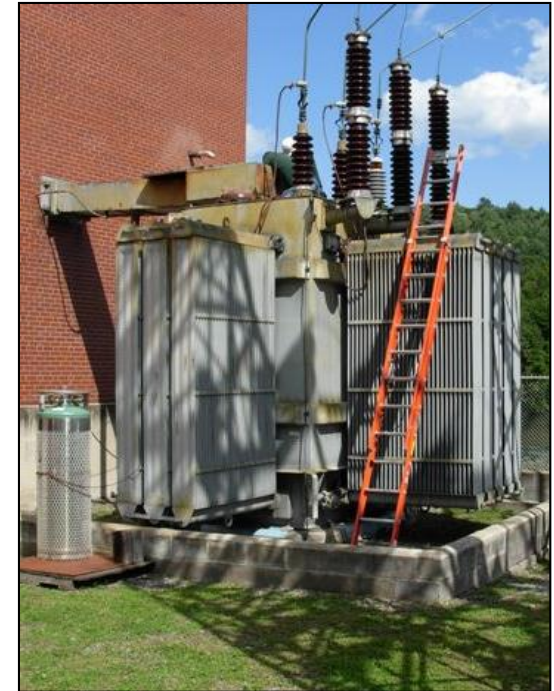
Ken Elkinson

Apparatus Analytics Engineer

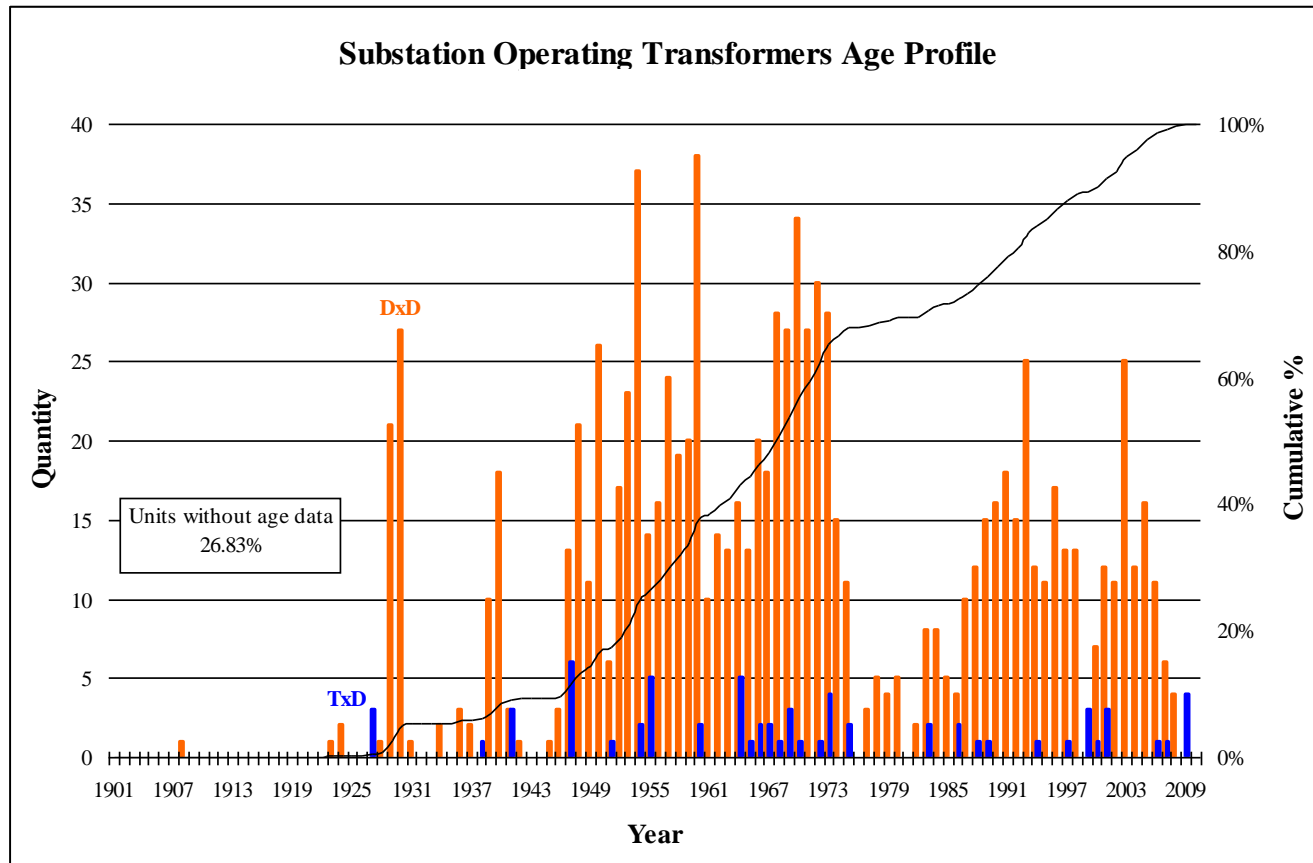
Doble Engineering Co.

Why is the condition of critical equipment important?

- OBJECTIVES:
- Identify Condition Status - Good & Bad
- Life Extension
- Maximize Assets
- Minimize Outages
- Safe & Productive Operation
- Insurance Compliance
- Industry Compliance
- Informed Decisions



Example - Substation Transformers Age Profile



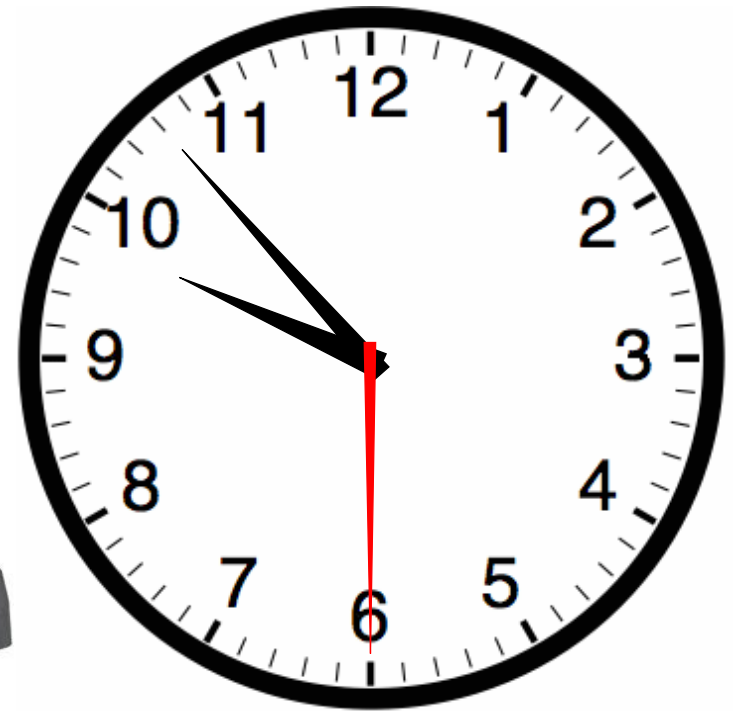
Why Condition Monitoring?



The Key is in Visualization

- Informative, role-based views for decision support
 - One person's critical assets are not another's
 - Concentrate on the things that are important to you
 - “At-a-glance” understanding of asset condition
 - Drill down to events
 - No need to search for information
 - Views provided within a geospatial, substation or asset context
 - SCADA-like in nature-e.g. live alarms, trends, status, values
- Provides real time, substation asset health
- System architecture allows rapid integration of new data sources, and then prototype & deployment of new views

Visualization of information is Important



Visualization of information is Important

◆ Anscombe Quartet data

Anscombe's Quartet							
Set I		Set II		Set III		Set IV	
Time	Condition	Time	Condition	Time	Condition	Time	Condition
4	4.26	4	3.1	4	5.39	8	5.25
5	5.68	5	4.74	5	5.73	8	5.56
6	7.24	6	6.13	6	6.08	8	5.76
7	4.82	7	7.26	7	6.42	8	6.58
8	6.95	8	8.14	8	6.77	8	6.89
9	8.81	9	8.77	9	7.11	8	7.04
10	8.04	10	9.14	10	7.46	8	7.71
11	8.33	11	9.26	11	7.81	8	7.91
12	10.84	12	9.13	12	8.15	8	8.47
13	7.58	13	8.74	13	12.74	8	8.84
14	9.96	14	8.1	14	8.84	19	12.5

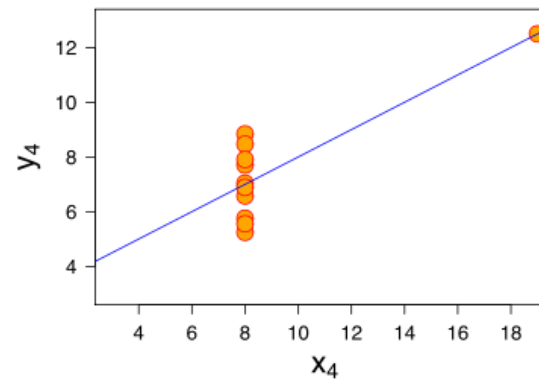
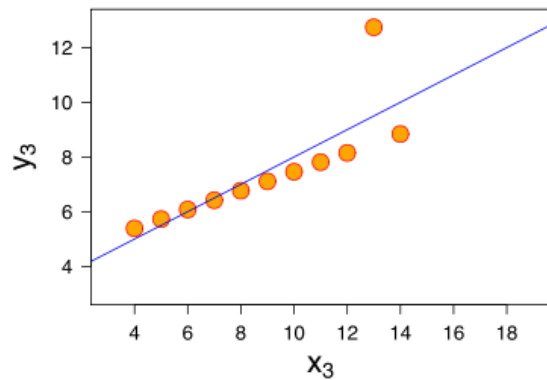
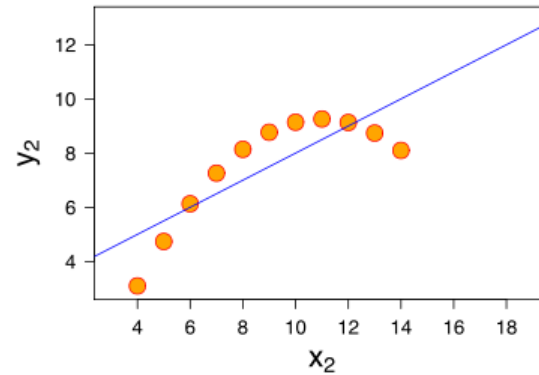
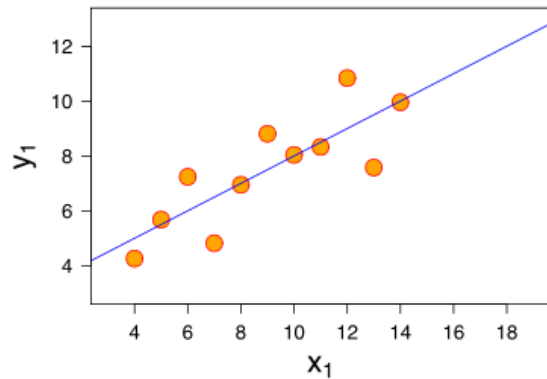
Visualization of information is Important

- ◆ Anscombe Quartet data – almost identical statistics

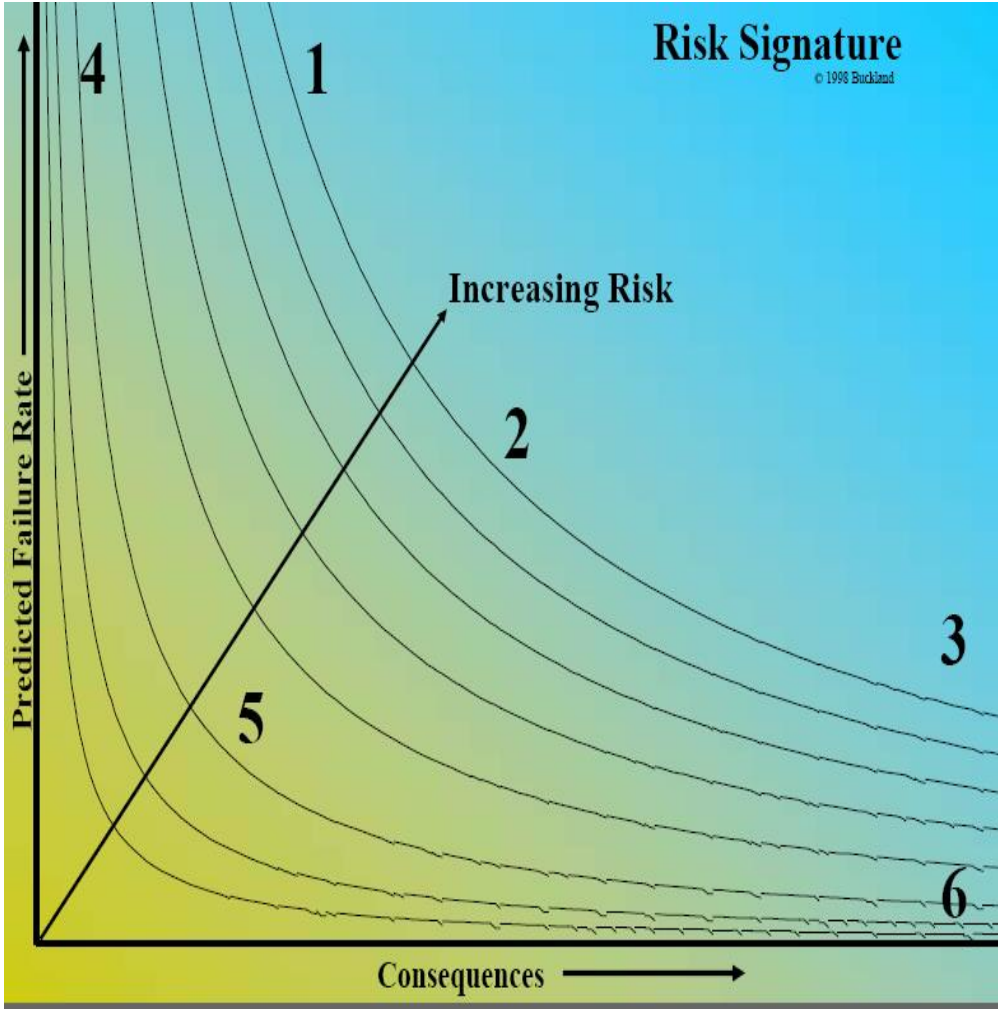
Property	Value
Mean of x in each case	9.0
Variance of x in each case	11.0
Mean of y in each case	7.5
Variance of y in each case	4.12
Correlation between x and y in each case	0.816
Linear regression line in each case	$y = 3 + 0.5x$

Visualization of information is Important

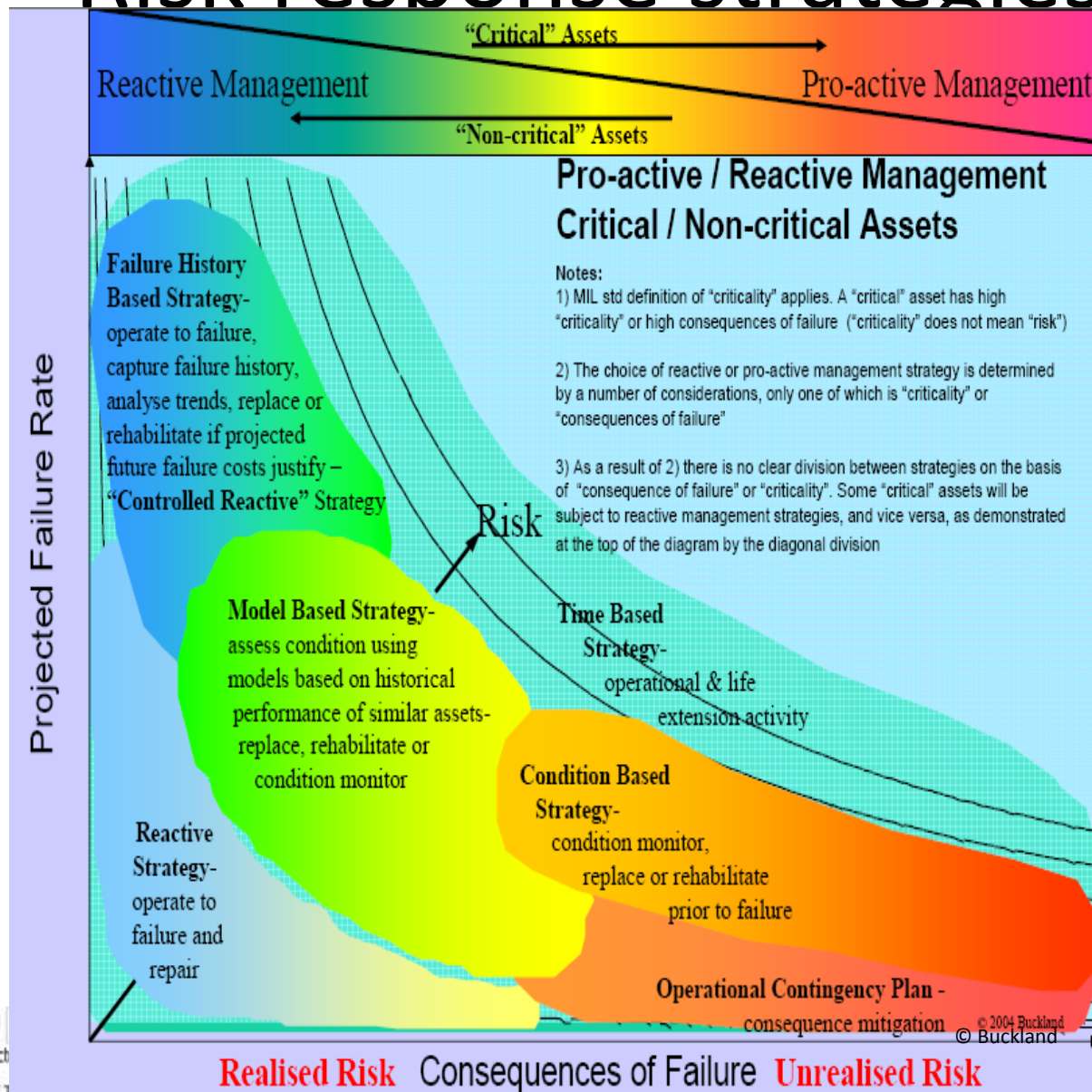
- Visualization of the Anscombe Quartet



Risk Signatures



Risk response strategies



Visualization


Reports Settings dobleDB Help About
DEMO
dobleARMS 2.0

Greater Boston > Quincy Substation > Transformer 2.0 2X1
 Start Time: 1-3d End Time: Apply
21 Region 21 Site 21 Asset

Asset

- Greater Boston
 - Everett Substation
 - Hingham Substation
 - Lynn Substation
 - Marlborough Substation
 - Quincy Substation
 - Transformer 2.0 2X1**
 - Bushings
 - DGA
 - Dielectric
 - Fluid
 - Mechanical
 - OLTC
 - Operational
 - Thermal
 - Transformer 2.0 2X2
 - Bushings
 - DGA
 - Dielectric
 - Fluid
 - Mechanical
 - OLTC
 - Operational
 - Thermal
 - Salem Substation
 - Tewksbury Substation
 - Whitman Substation
 - Wrentham Substation

Two Windings



Apparatus Rating

2 X Pier Ranking: 10/103



dSCORE: 13

Key Ind.

Phase	1	2	3
MVA	6.35	6.35	6.21
MVAR	0.53	0.53	0.52
MW	4.78	4.78	4.68
kV	140.23	140.04	138.29

Operational Status

Phase: 1 2 3 HV [kV] 145 145.9 132.1

MVA Phs 3 138 135 143.8 130.1

KVHV Phs 2

Key Parameters

LV [kV] 18.4 18 14.09 12.85

MVA Phs 12 12 12.08 10.85

MVAR Phs 3 12 12 12.08 10.85

KVLV Phs 2

OLTC

OLTC 1 OLTC 2 OLTC

OLTC Total Counter: 761 Current Position: 3 4/8/2013 4:33:44 PM



Cummulative Operations Per Position



Performance

Output

MVA [%] 47.81

Dynamic NaN

Seasonal Load [%]

Summer 67.58

Winter 65.39

Asset Life [%] NaN

Fluid Update

H2 [ppm]	Nitrogen	Fluid Moist. [ppm]	Relative Sat. %
3.00	1.44	15.10	25.30

Assessments

Category	Count	Status
Bushings	3	Mechanical
DGA	28	OLTC
Dielectric	11	Operational
Fluid		Thermal

COMM Status

- SCADA ●
- Protocols ●
- Gateway ●
- Sensors ●

dScore 4/8/2013 4:34:26 PM



Assessments

Category	dScore
Bushings	3
DGA	28
Dielectric	11
Operational	1

Log

Type	Timestamp	Source	Explanation
Notification	4/8/2013 1:34:00 AM	Operational\Unbalanced	Score has changed fr
Notification	4/8/2013 1:23:00 AM	Operational\Unbalanced	Score has changed fr
Notification	4/8/2013 12:54:00 AM	Bushings\H1Dielectric	Score has changed fr
Notification	4/7/2013 12:32:00 AM	Bushings\H1Dielectric	Score has changed fr
Notification	4/7/2013 12:25:00 AM	Bushings\H1Dielectric	Score has changed fr
Notification	4/6/2013 4:48:00 PM	Bushings\H1Dielectric	Score has changed fr
Notification	4/6/2013 4:46:00 PM	Bushings\H1Dielectric	Score has changed fr
Notification	4/6/2013 3:55:00 AM	Operational\Unbalanced	Score has changed fr
Notification	4/6/2013 1:30:00 AM	Operational\Unbalanced	Score has changed fr

Presentation Over

Thank you!!!

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