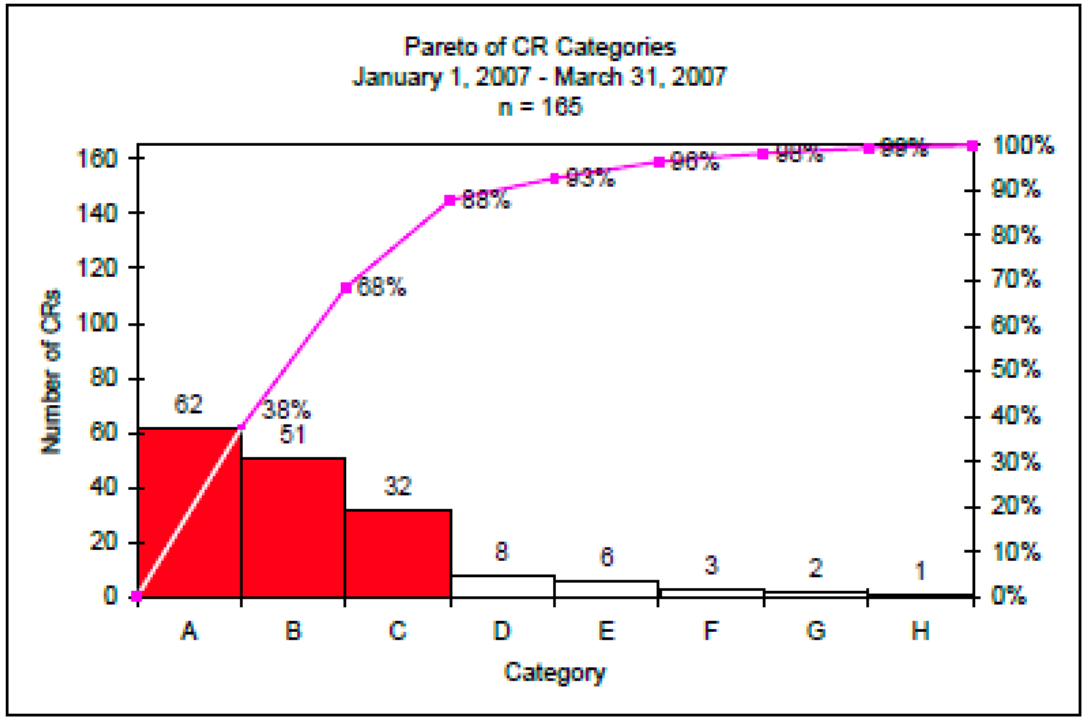
Trending Insights

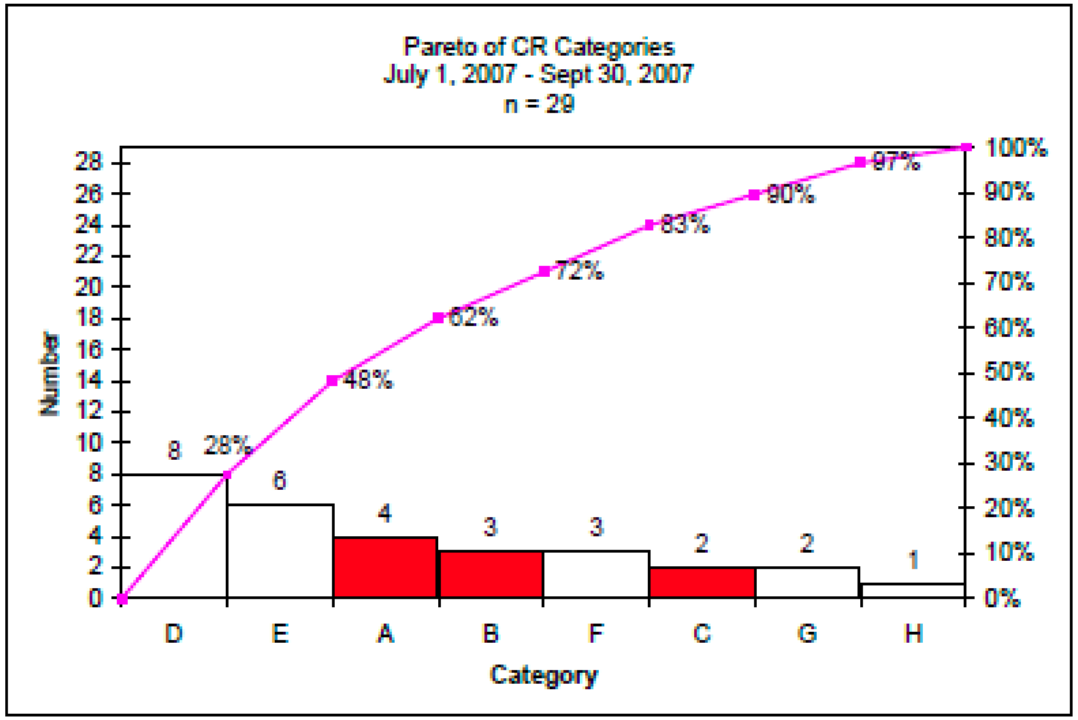
DEVONWAY

Real World vs. Trending Manuals

Pareto of Categories when Trend Identified



Pareto of Categories after corrective actions have been completed

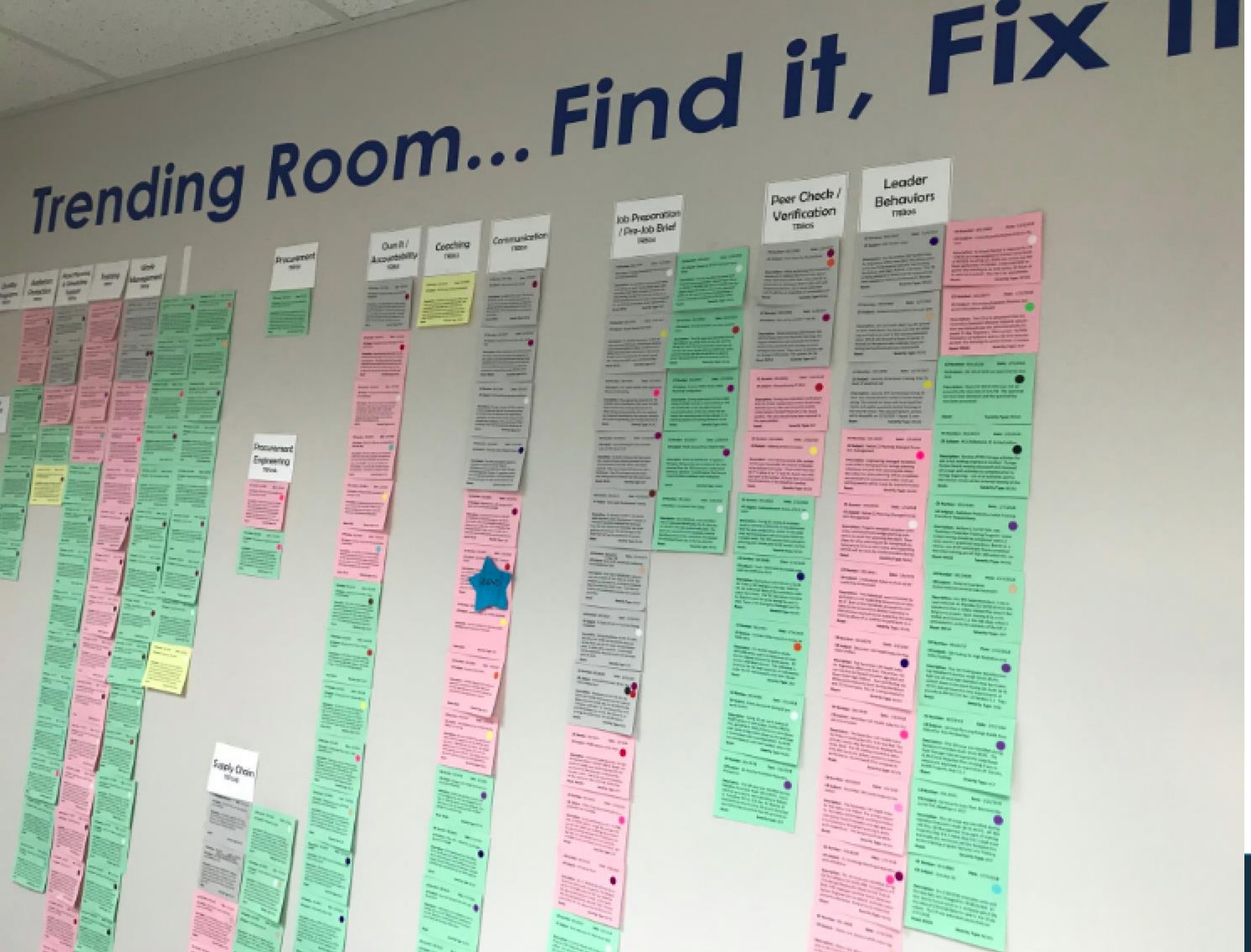


DEVONWAY

Trending Observations

Real-World Observations

- Customers place different value on trending
- Trending is losing some traction in some organizations, gaining in organizations, gaining in others
- Lots of things need to line up for effective trending
  - Data Quality
  - Data Consistency
  - Data Volume


Trending Room... Find it, Fix It
Procurement
Own It / Accountability
Coaching
Communication
Job Preparation / Pre-Job Brief
Peer Check / Verification
Leader Behaviors
Procurement Engineering
Supply Chain

DEVONWAY

Trending Ru

Followed INPO 07-007 Guidelines:

- Individual points above the Upper Control Limit
- Seven points in a row all above or below the average
- Seven points in a row either increasing or decreasing
- Ten out of eleven points in a row all above the average or below average or below the average
- Two out of three points in a row more than two standard standard deviations above or below the average
- Four out of five points in a row more than one standard above or standard above or below the average

Scoring Criteria

+ Criteria

Criteria	X	Y	Points
The most recent X out of Y points are above the mean	2	3	5
The most recent X points are increasing	2		5
The most recent X out of Y points are more than two standard deviations above the mean	1	1	25
The most recent X out of Y points are above the Upper Control Limit	1	1	25
The most recent X points are increasing	5		25
The most recent X out of Y points are more than one standard deviation above the mean	2	3	25
The most recent X out of Y points are above the mean	10	11	50
The most recent X out of Y points are more than one standard deviation above the mean	4	5	500
The most recent X points are increasing	7		500
The most recent X out of Y points are above the mean	7	7	500
The most recent X out of Y points are more than two standard deviations above the mean	2	3	500

Color Criteria

+ Criteria

If the score/value is greater than or equal to	But less than or equal to	Set the cell color to
0	4	White
5	35	Green
36	499	Yellow
500	9999	Red

Extending Trending Across Datasets

Performance Datasets to Include: Include:

- CAP
- Observations
- Assessments
- KPIs
- Effectiveness Reviews
- Other datasets

Major Events Invalidate Trending

Trending field	Date field	Trending profile
INPO Code	Event Date	INPO
Start date	**End date**	**Frequency**
03/01/2015	02/28/2016	Monthly

INPO Code	2015-Mar	2015-Apr	2015-May	2015-Jun	2015-Jul	2015-Aug	2015-Sep	2015-Oct	2015-Nov	2015-Dec	2016-Jan	2016-Feb
ER.1; EQUIPMENT PERFORMANCE - High le...	167	102	37	38	37	30	24	43	45	40	59	77
ER.2; EQUIPMENT FAILURE PREVENTION - ...	72	64	12	15	17	18	17	12	4	4	17	20
ER.3; LONG-TERM EQUIPMENT RELIABILITY...	42	52	50	37	51	47	81	63	53	57	68	86
FP.1; FIRE PROTECTION - The fire prot...	26	13	28	22	31	17	36	33	15	9	15	22
HU.1.06; Procedures and work document...	51	44	19	13	13	13	10	21	12	14	7	13
HU.1; HUMAN PERFORMANCE - Human perfo...	75	33	17	8	8	15	18	5	12	14	11	3
NO INPO CODE; No INPO Code has been a...	69	73	30	27	29	26	20	15	7	18	20	22
TR.1; TRAINING - A systematic approac...	16	21	27	14	13	0	3	2	0	5	2	1
WM.1.02; Delay / Schedule Adherence -...	110	33	12	19	14	13	10	14	4	14	6	9
WM.1; ON-LINE AND OUTAGE WORK MANAGEM...	31	42	31	24	2	1	1	2	7	0	0	0

DEVONWAY

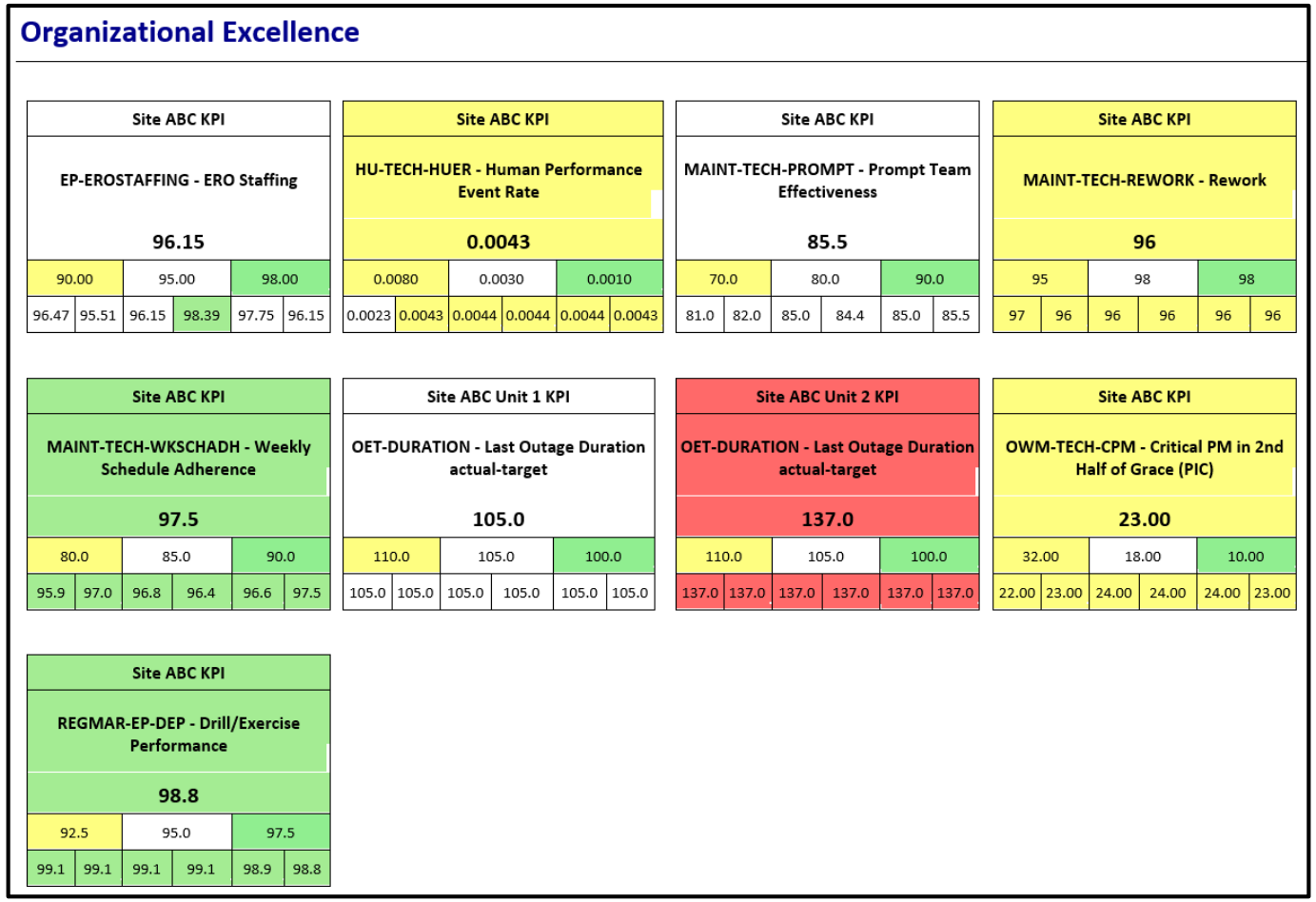
Consistency and Continuity

Trending field: INPO Code | Date field: Event Date | Trending profile: INPO

Start date: 02/01/2015 | End date: 02/28/2016 | Frequency: Monthly

INPO Code	2015-Feb	2015-Mar	2015-Apr	2015-May	2015-Jun	2015-Jul	2015-Aug	2015-Sep	2015-Oct	2015-Nov	2015-Dec	2016-Jan
CM.2; OPERATIONAL CONFIGURATION CONTR...	2	3	4	2	5	4	5	1	6	5	9	7
CM.3; DESIGN CHANGE PROCESSES - Chang...	0	3	2	0	9	13	13	10	11	17	23	7
EP.2.3; Emergency Preparedness Drills...	1	8	1	23	5	1	1	11	22	10	1	1
ER.1; EQUIPMENT PERFORMANCE - High le...	1	4	7	19	35	78	75	76	52	56	51	75
ER.4; MATERIALS RELIABILITY - Activit...	0	0	0	1	31	23	9	9	13	1	6	16
HU.1; HUMAN PERFORMANCE - Human perfo...	1	0	1	1	5	3	10	13	15	9	4	7
IS.1.16; Safety Hazards - Safety haza...	0	0	0	0	11	16	12	3	13	5	14	12
NO INPO CODE; No INPO Code has been a...	304	345	341	383	175	41	46	30	41	28	20	9
SF.1; Security Issues (e.g., badging,...	2	5	8	7	4	10	7	4	20	24	16	41
WM.1.02; Delay / Schedule Adherence -...	0	0	3	0	2	9	2	12	5	8	13	9

Trending as a Balance to KPIs



Organizational Excellence

Site ABC KPI					
EP-EROSTAFFING - ERO Staffing					
96.15					
90.00		95.00		98.00	
96.47	95.51	96.15	98.39	97.75	96.15

Site ABC KPI					
HU-TECH-HUER - Human Performance Event Rate					
0.0043					
0.0080		0.0030		0.0010	
0.0023	0.0043	0.0044	0.0044	0.0044	0.0043

Site ABC KPI					
MAINT-TECH-PROMPT - Prompt Team Effectiveness					
85.5					
70.0		80.0		90.0	
81.0	82.0	85.0	84.4	85.0	85.5

Site ABC KPI					
MAINT-TECH-REWORK - Rework					
96					
95		98		98	
97	96	96	96	96	96

Site ABC KPI					
MAINT-TECH-WKSCHADH - Weekly Schedule Adherence					
97.5					
80.0		85.0		90.0	
95.9	97.0	96.8	96.4	96.6	97.5

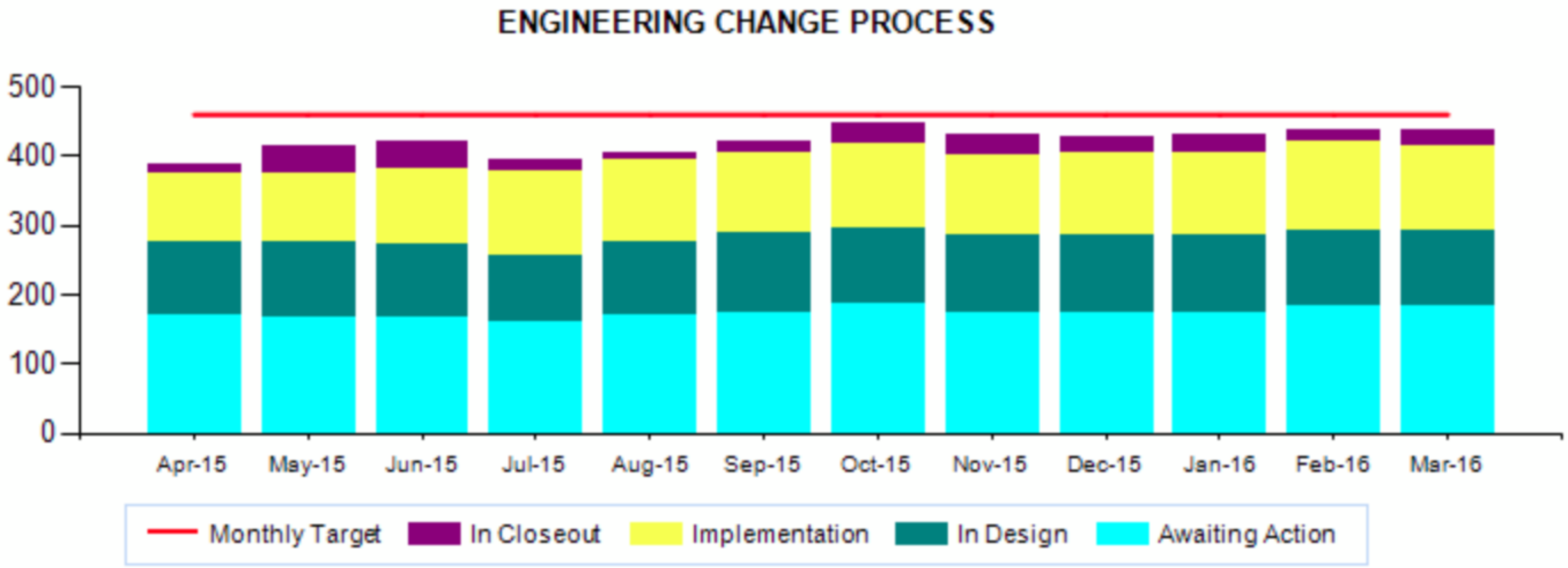
Site ABC Unit 1 KPI					
OET-DURATION - Last Outage Duration actual-target					
105.0					
110.0		105.0		100.0	
105.0	105.0	105.0	105.0	105.0	105.0

Site ABC Unit 2 KPI					
OET-DURATION - Last Outage Duration actual-target					
137.0					
110.0		105.0		100.0	
137.0	137.0	137.0	137.0	137.0	137.0

Site ABC KPI					
OWM-TECH-CPM - Critical PM in 2nd Half of Grace (PIC)					
23.00					
32.00		18.00		10.00	
22.00	23.00	24.00	24.00	24.00	23.00

Site ABC KPI					
REGMAR-EP-DEP - Drill/Exercise Performance					
98.8					
92.5		95.0		97.5	
99.1	99.1	99.1	99.1	98.9	98.8

Design Engineering Activity

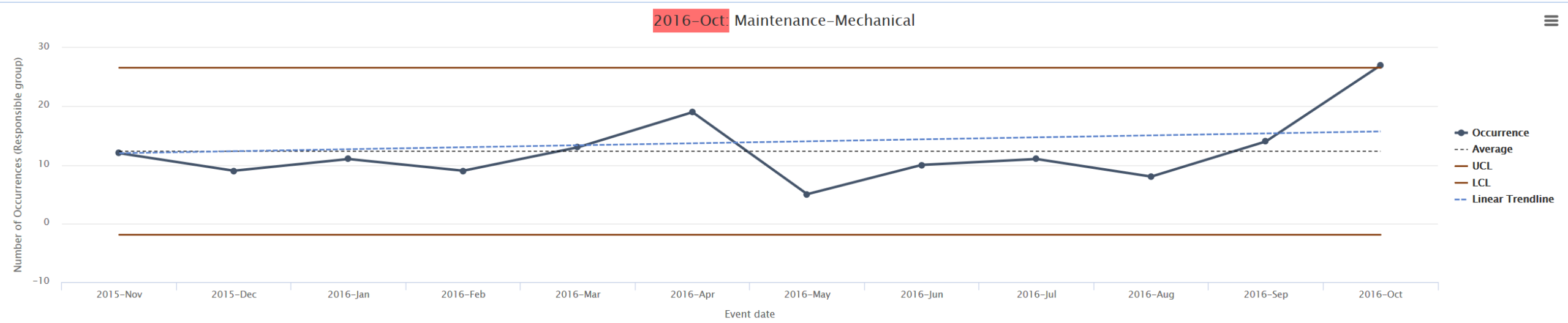


Carve Out Good Catches When Considering Observations

Trending field	Date field	Trending profile
Responsible group	Event date	INPO
Start date	**End date**	**Frequency**
01/01/2016	12/31/2016	Monthly

Responsible group	2016-Jan	2016-Feb	2016-Mar	2016-Apr	2016-May	2016-Jun	2016-Jul	2016-Aug	2016-Sep	2016-Oct	2016-Nov	2016-Dec
Construction	5	4	12	28	6	4	13	6	5	32	15	13
Engineering Projects	10	3	13	19	3	8	4	16	14	32	19	4
Maintenance-Electrical	13	9	13	11	12	11	16	12	8	20	21	22
Maintenance-I&C	8	5	8	17	6	6	3	4	6	13	6	9
Maintenance-Mechanical	11	9	13	19	5	10	11	8	14	27	17	20
Site Procedure Group	10	9	12	4	8	11	12	3	4	7	3	12
Site Protective Services-Security	33	35	36	22	13	33	17	23	23	23	18	21
System Engineering Electrical	3	6	5	3	3	1	2	0	5	6	3	3
Training	10	8	6	1	11	4	3	4	9	1	0	3
Win Team	6	3	5	2	5	7	5	6	2	2	6	10

Carve Out Good Catches When Considering Observations



Trend data

2015-Nov	2015-Dec	2016-Jan	2016-Feb	2016-Mar	2016-Apr	2016-May	2016-Jun	2016-Jul	2016-Aug	2016-Sep	2016-Oct
12	9	11	9	13	19	5	10	11	8	14	27

Score: 530 (red)
Profile: INPO
Average: 12.33
Lower control limit: -1.93
Upper control limit: 26.59
Std dev: 5.77

Score Criteria

- [5 points] The most recent X out of Y points are above the overall mean
- [25 points] The most recent X out of Y points are more than two standard deviations above the mean
- [500 points] The most recent X out of Y points are above the Upper Control Limit

DEVONWAY

Carve Out Good Catches When Considering Observations

Trending field	Date field	Trending profile
Work Group Observed	Observation Date	Heat Map
Start date	**End date**	**Frequency**
01/01/2016	12/31/2016	Monthly

Work Group Observed	2016-Jan	2016-Feb	2016-Mar	2016-Apr	2016-May	2016-Jun	2016-Jul	2016-Aug	2016-Sep	2016-Oct	2016-Nov	2016-Dec
Facilities	5	4	0	0	0	2	3	3	3	1	0	2
IT Real Time	1	1	1	1	0	1	1	1	0	1	1	1
Maintenance	10	6	2	2	1	6	0	5	4	33	5	1
Maintenance Reactor Services	6	12	2	3	1	0	4	2	1	15	8	3
Maintenance-Electrical	12	7	10	3	4	2	2	9	10	0	1	1
Maintenance-I&C	13	8	0	3	5	0	1	2	6	2	3	2
Maintenance-Mechanical	10	3	6	4	4	5	7	6	6	31	13	4
Nuclear Business Serv.-Accounting	1	1	1	0	1	1	0	0	0	0	0	0
Nuclear Business Services	2	2	1	1	2	1	1	1	2	1	0	0
Nuclear Business Services-Planning/Budge	1	1	0	1	1	1	0	1	0	0	0	0
Nuclear Documents Mgmt	1	1	1	1	1	1	1	1	1	0	1	0

Carve Out Good Catches When Considering Observations

Trending field	Date field	Trending profile
Responsible group	Event date	INPO
Start date	**End date**	**Frequency**
01/01/2016	12/31/2016	Monthly

Responsible group	2016-Jan	2016-Feb	2016-Mar	2016-Apr	2016-May	2016-Jun	2016-Jul	2016-Aug	2016-Sep	2016-Oct	2016-Nov	2016-Dec
Construction	0	0	2	10	1	1	0	4	1	17	8	7
Cyber Security	0	0	0	1	0	0	0	0	0	0	2	96
Engineering Projects	2	1	3	9	0	1	2	4	1	9	3	3
Maintenance-Electrical	1	1	4	6	4	2	3	1	1	7	4	5
Maintenance-I&C	3	2	4	12	2	4	0	2	0	9	2	5
Maintenance-Mechanical	5	1	7	10	0	5	4	1	4	6	9	9
Site Protective Services-Security	17	12	9	7	4	17	5	8	8	5	4	3
System Engineering Electrical	1	2	1	1	2	0	1	0	2	4	3	3
System Engineering NSSS	2	1	1	2	3	1	1	2	2	4	4	5
Win Team	3	1	3	1	3	4	1	1	0	2	3	2

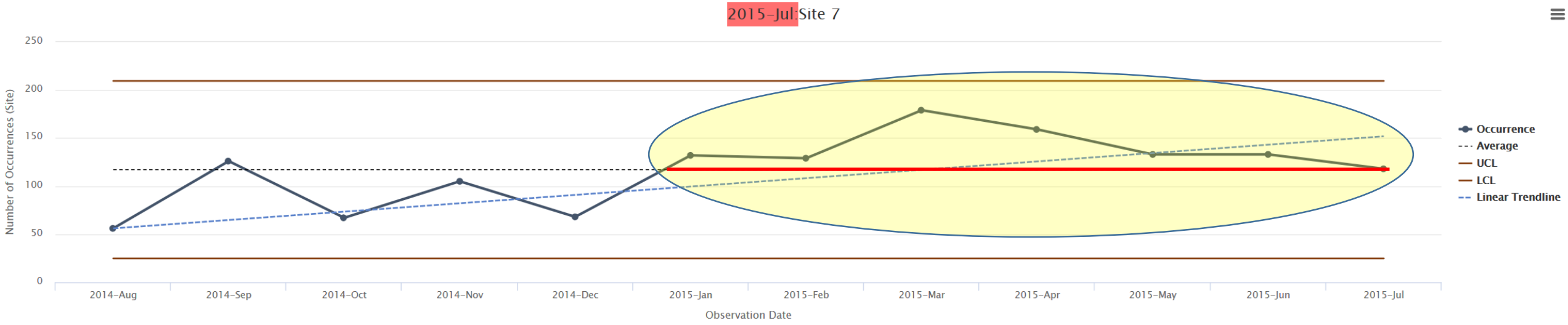
Benchmarking Human Errors

Trending field	Date field	Trending profile
Site	Observation Date	INPO
Start date	**End date**	**Frequency**
01/01/2015	12/31/2015	Monthly

Site	2015-Jan	2015-Feb	2015-Mar	2015-Apr	2015-May	2015-Jun	2015-Jul	2015-Aug	2015-Sep	2015-Oct	2015-Nov	2015-Dec
Site 1	156	117	131	187	244	187	190	149	145	316	175	229
Site 2	56	61	55	61	69	125	122	90	116	109	114	142
Site 3	79	71	86	87	86	111	79	84	94	138	141	112
Site 4	141	174	128	183	147	146	145	110	115	146	174	168
Site 5	94	91	109	161	111	136	128	102	78	154	131	110
Site 6	209	175	281	206	199	202	210	173	133	290	295	358
Site 7	132	129	179	159	133	133	118	106	110	143	98	119
Site 8	138	147	172	162	174	199	184	162	181	169	199	174
Site 9	59	77	76	84	122	131	150	105	105	132	101	114

DEVONWAY

Benchmarking Human Errors



Trend data

2014-Aug	2014-Sep	2014-Oct	2014-Nov	2014-Dec	2015-Jan	2015-Feb	2015-Mar	2015-Apr	2015-May	2015-Jun	2015-Jul
56	126	67	105	68	132	129	179	159	133	133	118

Score: 505 (red)
Profile: INPO
Average: 117.08
Lower control limit: 24.7
Upper control limit: 209.46
Std dev: 37.34

Score Criteria

- [5 points] The most recent X out of Y points are above the overall mean
- [500 points] The most recent X out of Y points are above the overall mean

DEVONWAY

Security Example: Incidents & Observations

Owner's department group	2016-Jan	2016-Feb	2016-Mar	2016-Apr	2016-May	2016-Jun	2016-Jul	2016-Aug	2016-Sep	2016-Oct	2016-Nov	2016-Dec
Engineering	265	260	246	213	458	202	193	174	188	179	157	154
Maintenance	257	279	287	253	516	277	209	232	229	237	247	277
Operations	92	90	113	77	169	62	51	51	48	63	60	71
Other	32	29	51	37	19	9	12	13	11	19	8	22
Reg Affairs	14	9	10	5	6	7	9	9	9	2	7	6
Safety / RP	44	64	50	49	127	35	26	40	33	38	34	29
Security	61	68	81	83	85	80	70	61	65	48	56	42
Site Services	15	23	14	41	102	56	39	39	43	34	52	51
Training	47	41	39	18	27	12	31	28	27	44	32	114
Work Control / Outage	40	49	54	58	81	49	46	42	54	48	30	47

Observation Card	2016-Mar	2016-Apr	2016-May	2016-Jun	2016-Jul	2016-Aug	2016-Sep	2016-Oct	2016-Nov	2016-Dec
Security - Security Observation Card	6	8	3	10	10	14	51	14	9	16

Extending Trending Across Your Data

Leak related?	2016-Jan	2016-Feb	2016-Mar	2016-Apr	2016-May	2016-Jun	2016-Jul	2016-Aug	2016-Sep	2016-Oct	2016-Nov	2016-Dec
No	207	156	233	219	133	162	148	156	164	262	179	281
Yes	3	2	9	9	8	5	19	9	8	15	16	13

Crew	2015-Jan	2015-Feb	2015-Mar	2015-Apr	2015-May	2015-Jun	2015-Jul	2015-Aug	2015-Sep	2015-Oct	2015-Nov	2015-Dec
1	19	17	20	84	22	19	16	25	16	20	18	27
2	6	9	2	3	2	4	6	0	7	0	1	6
3	5	3	4	24	4	2	2	6	1	1	1	5
4	15	10	7	18	5	11	16	14	4	5	4	5
7	13	5	5	3	1	2	7	3	4	2	10	1
A	54	55	64	71	62	114	85	75	91	91	61	56
B	62	43	73	32	64	77	88	87	71	72	63	38
C	48	53	69	45	67	99	93	106	79	75	87	45
D	43	58	64	37	48	88	78	63	71	70	61	53
E	65	47	56	29	43	76	80	65	58	65	31	46

Other data points trended

Component Criticality	Condition Level	Discipline
Equipment Affected	Priority	Responsible Group
Work Request Priority	Work Request Type	Etc.

More Frequent Trending When Appropriate

Trending field	Date field	Trending profile
Trend	Event date	INPO
Start date	**End date**	**Frequency**
01/01/2016	12/31/2016	Weekly

2016-Aug-21	2016-Aug-28	2016-Sep-04	2016-Sep-11	2016-Sep-18	2016-Sep-25	2016-Oct-02	2016-Oct-09	2016-Oct-16	2016-Oct-23	2016-Oct-30	2016-Nov-06	2016-Nov-13
0	0	2	2	1	0	1	2	1	0	0	1	1
5	2	2	3	3	4	5	12	9	13	4	5	0
7	11	6	10	5	10	11	14	20	18	12	9	3

Why is Trending Important?

Regulatory requirement

...Verify that trend evaluations are performed in a manner and at a frequency that provides for prompt identification of adverse quality trends. Verify that trend evaluations are distributed to affected organization management. Verify that identified adverse trends are reported to the management of the organization responsible for corrective action.

- NRC Inspection Manual, Quality Assurance Problem Identification & Resolution

Why is Trending Important?

- Meet regulatory guidance
- If you're going to respond to a trend, respond to a trend
- Manage by facts
- Extend performance assessment toolbox
- Effective internal and external benchmarking
- Support sound decision making
- Strengthen your business case
- Validates the importance of your safety observation program
- Validates the administrative overhead that comes with CAP

Successful Trending

DevonWay Trending Best Practices

- Keep it simple
- Decentralize trending
- Trending as a general-purpose tool like search
- Relatively small trend code library
- Emphasize consistency
- Re-baselining is critical
- Apply statistical rules that fit – what-if analysis

Matt Sacks

msacks@devonway.com

DEVONWAY