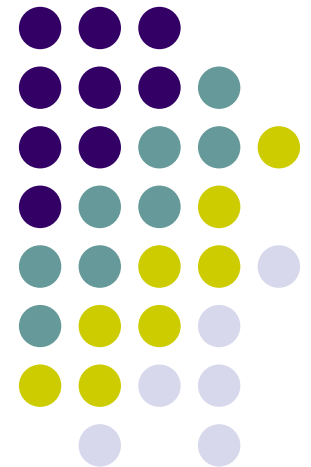
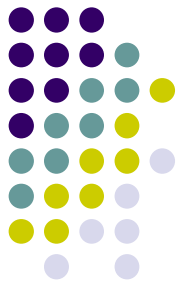


Hu Indicators

Thomas A. Kriesel
INPO



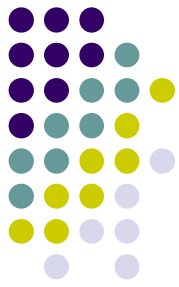


CONTENT

- **Background**
- **Basis**
- **Goals**
- **Performance Indicators**
 - Results
 - Contributor or Predictor
- **Use of Data**
- **Pilot Results**
- **What's Next**

How did we get here?

Background



- λ **Executive Review Group now Executive Advisory Group (EAG) recommends industry standard metrics for human performance in 2004**
- λ **Industry Meeting was convened in March 2005**
- λ **Co-Sponsored by INPO and Dominion**
- λ **Attended by: 23 Plants from 12 utilities**

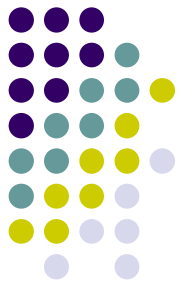
How did we get here?

Background Continued



- λ **Data collected in 2006 from 17 plants**
- λ **Modifications to data set based on OE**
- λ **Meeting June 2007**
- λ **Industry Good Practice is in Preparation**

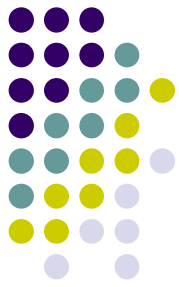
Participants - 2005



- λ Dawn Rodgers (Boudrie) - Fermi II (Team Lead)
- λ Pat Conley - Southern Co. - Vogtle
- λ Eric DiLandro - Dominion
- λ Don Goble - FPL - Turkey Point
- λ Rey Gonzalez - SONGS
- λ Hoppy Hopkinson - Duke - McGuire
- λ Peg Lucky - INPO
- λ Tim Northcutt - SCANA - VC Summer
- λ John Owens - Dominion - Kewaunee
- λ April Rice - SCANA - VC Summer
- λ Kevin Robinson -Duke - McGuire



2006 Data Provided by



Beaver Valley

Palo Verde

Oyster Creek

Nine Mile Point

D. C. Cook

Diablo Canyon

Columbia

SONGS

Pickering A

Pickering B

Darlington

Wolf Creek

Callaway

Bruce A

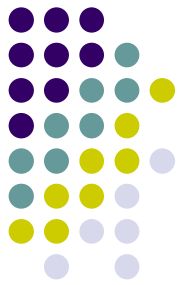
Bruce B

Perry

Davis Besse

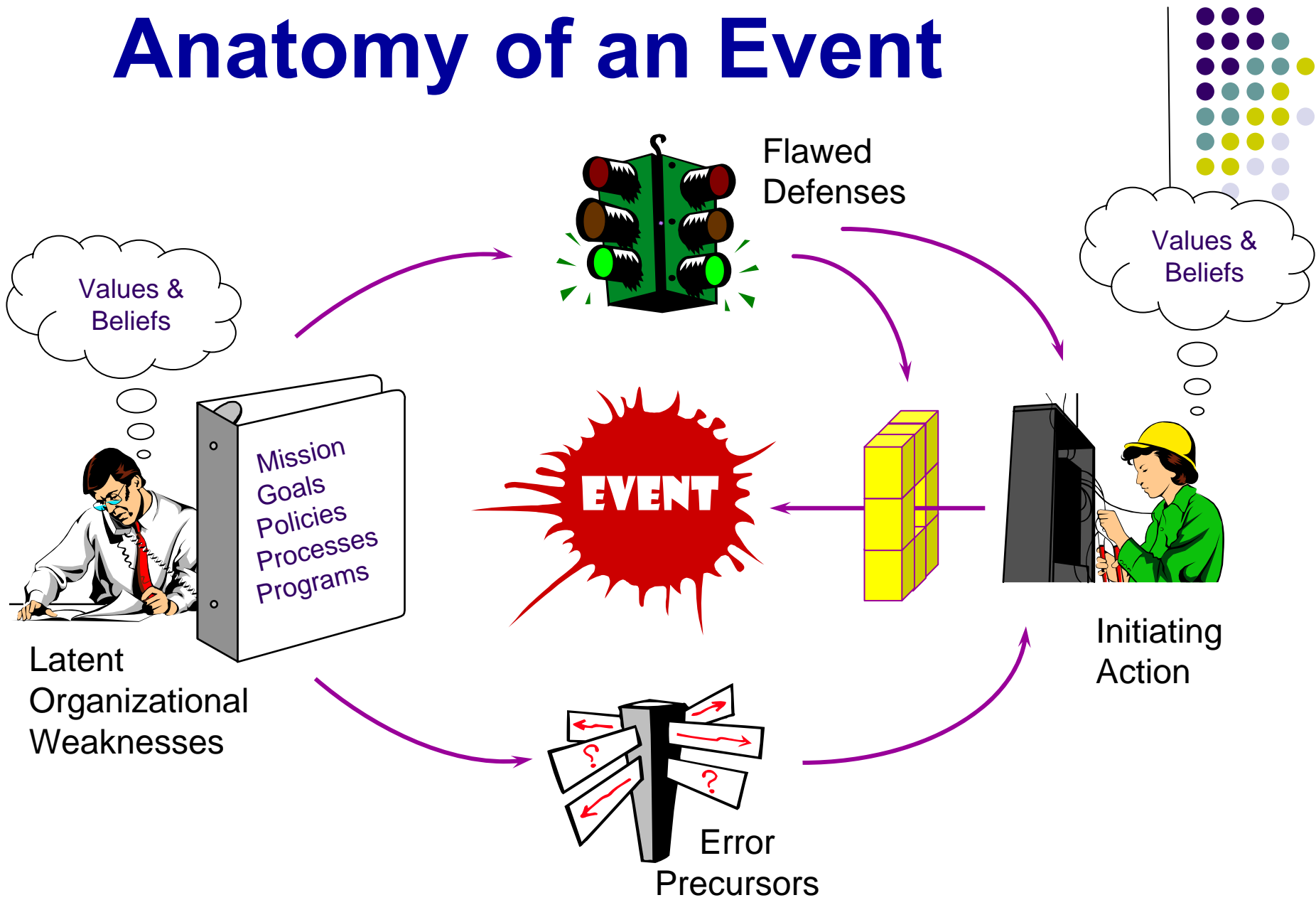


Final Meeting June 2007



Colleen Frabotta -	Beaver Valley	Mike LaPoint -	Nine Mile
	Perry		
	Davis Besse	Jim Gratto -	Pickering A
			Pickering B
Jim Glass -	Palo Verde		Darlington
		Dallas Conley -	Wolf Creek
Dave Montgomery -	Cooper	Mary Bellengee	
Wink Henson -	Callaway	Larry Bird -	Bruce A
			Bruce B
Pete Bedesem -	Diablo Canyon		
		Kevin Robinson -	McGuire
Marian Hayden -	Columbia		
		Karen Hutchings -	INPO
Brad Castiglia -	Kewaunee		
		Tom Kriesel -	INPO
Eric Dilandro -	Dominion		

Anatomy of an Event



Strategic Approach



Minimum **frequency** and **severity** of
plant events

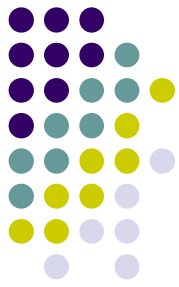
$$R_e + M_d \rightarrow \emptyset E$$

Committee Goals!



- λ Define Error and Event
- λ Determine Site Event Free Day Reset Criteria
- λ Establish HU Composite Index
- λ Suggest initial criteria for Department Event Free Day Reset Criteria.
- λ Determine Goals and Tracking Methodology

Site EFD Criteria



- λ **Nuclear Safety /
Operational Event**
- λ **Radiological Safety**
- λ **Industrial Safety**
- λ **Regulatory Event**

Event Measurements



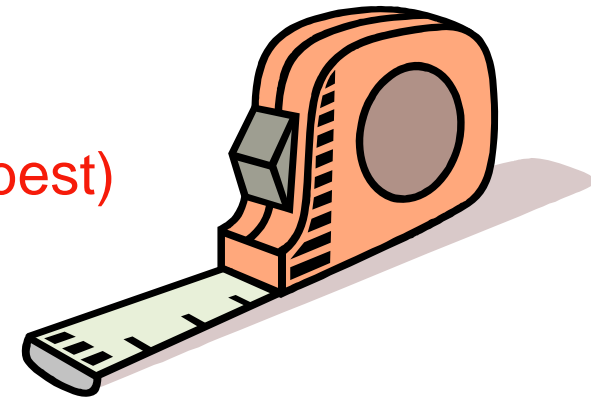
$$\text{Event Rate} = \frac{\# \text{ of events (over last 18 mos.)} \times 10,000}{\text{Total person hrs. worked over last 18 mos.}}$$

Avg. # days between last 6 events =

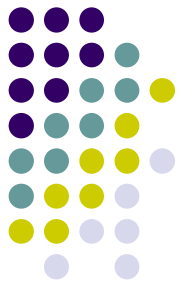
$$\frac{\text{date of last event (6}^{\text{th}} \text{ event)} - \text{date of 1}^{\text{st}} \text{ event}}{5}$$

$$\text{Success Rate} = \frac{\text{Best Plant Event Rate}}{\text{Plant Event Rate}}$$

(i.e., $.020/.040 = .5$ or 50% of the best)



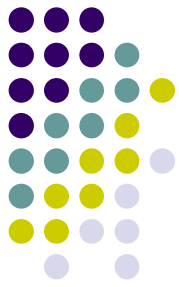
Department EFD Criteria



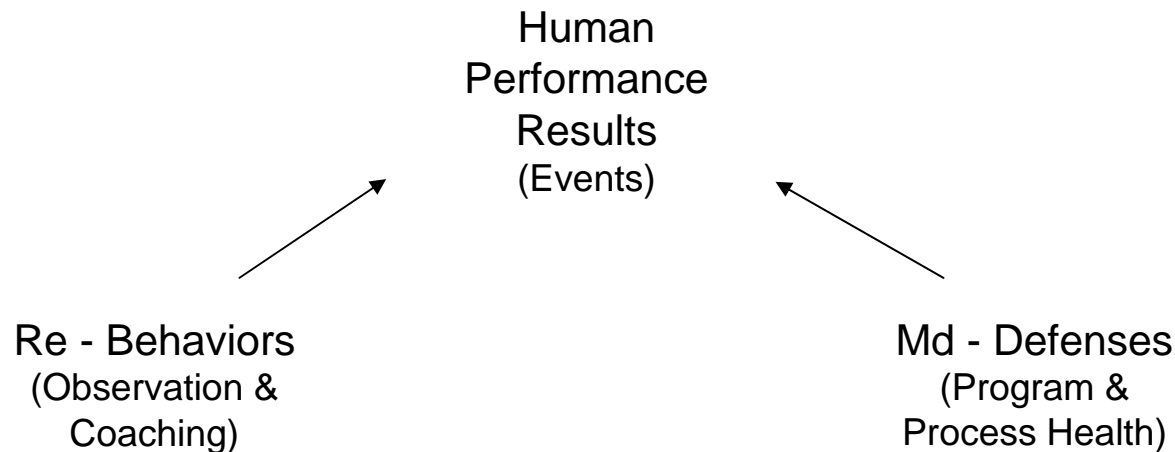
Suggested - Step-down from Site Criteria

- λ Nuclear Safety / Operational Event
- λ Radiological Safety
- λ Industrial Safety
- λ Regulatory Event

HU Composite Index

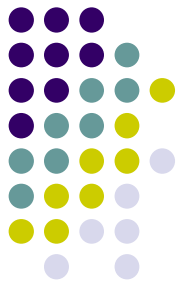


$Re + Md \rightarrow \emptyset E$
Reducing Errors + Managing Defenses = No Events



(Re) Behaviors & (Md) Defenses are two diagnostics used as validators and input into the final Composite Index score.

HU Composite Index



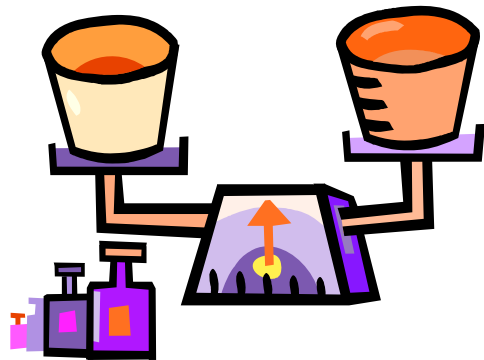
λ Section One

λ Human Performance Results (Events) or Results of "What's Happening"

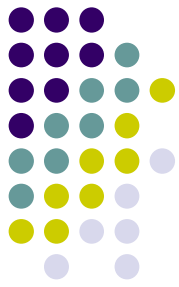
λ Section Two

λ Defenses (Program and Process Health) Contributors/Predictors

λ **Items from section one and section 2 are designed to complement**



Final Site EFD Criteria



- λ **Nuclear Safety**
- λ **Radiological Safety**
- λ **Industrial Safety**
- λ **Operational Event**
- λ **Regulatory Event**

Final Site EFD Criteria



When an event occurs as described in the table below as a result of the following:

- 1. An initiating action by an individual or group of individuals that is in error (Re) (event that results from an active error)**

OR

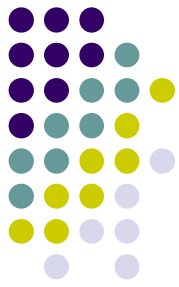
- 2. An initiating action by an individual or group of individuals during an activity that is conducted as planned (Md) - (event that results from a flawed defense or latent organizational weakness that was created within the last 18 months)**

Nuclear Safety Site Level



- a. **Event that requires emergency plan activation**
- b. **Unplanned mode change**
- c. **Unexpected / Unplanned reactivity change $\geq 3\%$ power (Event per the site Reactivity Management Program)**
- d. **Unplanned entry into a technical specification shutdown action statement ≤ 72 hours**
- e. **Errors that result in a damaged fuel bundle, or misplaced, ungrappled bundle.**
- f. **Unplanned increase to either of the two highest on-line or shutdown risk threshold colors/numbers**
- g. **Mis-operation, mis-position, or improper configuration of equipment needed for nuclear safety, such that it would not perform its design function.**

Radiological Safety Site Level



Loss of radiological control such as:

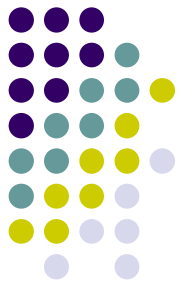
- a. A loss of radioactive material which creates a measurable exposure rate at 30 centimeters outside the protected area, or**
- b. any technical specification high radiation (area > 1 rem per hour) or very high radiation area occurrence that would generate a Licensee Event Report (LER), or any notification per 10 CFR 20_or**
- c. A Radiological Effluent Technical Specification or Off Site Dose Calculation Manual effluent occurrence.**
- d. Unplanned exposure (unintended exposure occurrence) ≥ 100 mrem over the estimate for an individual's exposure**

Industrial Safety Site Level



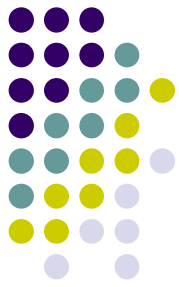
- a. **An occupational fatality, lost-time accident, or injury resulting in restricted duty**

Facility Operation Site Level



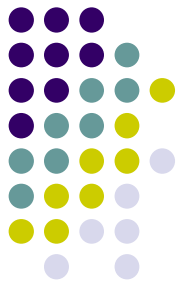
- a. **Mis-operation, mis-position, or improper configuration of equipment needed for power production, such that it reduced power by 10%.**
- b. **An unplanned or unscheduled reactor trip or turbine trip**
- c. **Switching/tagging/wrong component error that results in one of the following:**
 - λ **work being released to the field and clearance verified by the performing department**
 - λ **work performed that results in inadequate equipment or personnel protection**
- d. **Property damage to the facility in excess of \$100,000**

Regulatory Event Site Level



- a. **National Pollution Discharge Elimination System (NPDES), Occupational Safety and Health Administration (OSHA), or Environmental Protection Agency (EPA) noncompliance requiring a report in less than 30 days.**
- b. **Security report per 10 CFR 73.71 (excluding loggable events)**
- c. **Report per 10 CFR 50.72 or 10 CFR 50.73**
- d. **NRC Finding >Green, if the issue has not previously reset the clock based on other reset criteria.**

Department EFD Reset Criteria



When an event or condition occurs, as described in the table below, as a result of the following:

- 1. An initiating action by an individual or group of individuals that is in error (Re) (results from an active error)**

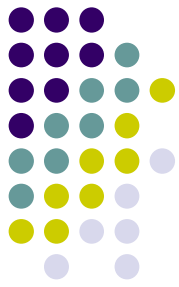
OR

- 2. An initiating action by an individual or group of individuals during an activity that is conducted as planned (Md) - (results from a flawed defense or latent organizational weakness)**

OR

- 3. Any event that resets the station event free day clock. The department clock is reset if the event happens, or is contributed to, by that department.**

Nuclear Safety Department Level



- a. **Unplanned increase of on-line or shutdown risk level**
- b. **Unplanned Tech Spec LCO Action Statement Entries**
- c. **Any report that identifies precursors in behaviors or conditions that could result in reactivity events. (Near Miss)_(as described in the site reactivity control guidance document)**
- d. **Mis-operation, mis-position, or improper configuration of equipment such that it would not perform its nuclear safety design function or causes a significant transient.**
- e. **Fuel damaging event as the result of foreign material intrusion**

Radiological Safety Department

Level



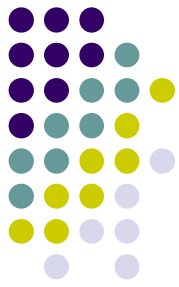
- a. **Violation of Radiological Work Permit (RWP) or Radiological Controls that leads to**
 - λ **Unplanned dose,**
 - λ **Uncontrolled Radioactive Material found outside the RCA**
 - λ **Unplanned contamination of space that is not normally contaminated**
 - λ **Unexpected personal electronic dosimeter total dose alarm**
 - λ **Unplanned release of radioactive material in plant effluent**

Industrial Safety Department Level



- a. **OSHA Recordable Injury**
- b. **A preventable motor vehicle accident involving company vehicle**
- c. **Chemical Control Program or procedure adherence issue beyond coaching**
- d. **Failure to follow or meet the requirements of the following programs that result in an increased potential for or actual occupational injury:**
 - λ **Hazardous Material Program**
 - λ **Chemical Control Program**
 - λ **Confined Space Program**
 - λ **Electrical Safety Program**
 - λ **Lifting and Rigging Program**

Facility Operation Department Level



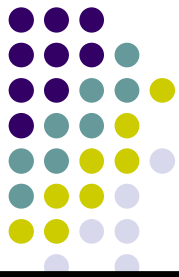
- a. **Unplanned power change**
- b. **Property damage > \$10,000**
- c. **Foreign Material Exclusion program or procedure adherence issue or event as the result of foreign material intrusion**
- d. **Mis-operation, mis-position, or improper configuration of equipment such that it would not perform its design function or cause a significant transient. Such as leaving a sample valve open on an important tank or system for plant operation.**
- e. **Failure to follow or meet the requirements of the following programs that result in an increased potential for or actual equipment damage:**
 - λ **Electrical Safety Program**
 - λ **Lifting and Rigging Program**
 - λ **Foreign Material Exclusion Program**
 - λ **Conduct of Maintenance**
 - λ **Conduct of Operations**
 - λ **Conduct of Engineering**

Regulatory Action Department Level



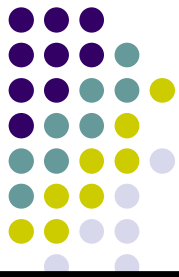
- a. **Security Loggable event as per Regulatory Guide 5.62**
- b. **Missed Technical Specification or other regulatory required surveillance**
- c. **NRC green finding or Non-Cited Violation (NCV)**

Trend Contributor or Predictor Indicators



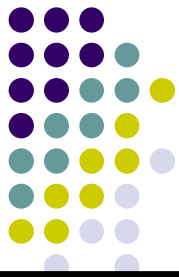
Performance Measure	Description
Industrial Safety for the quarter	This indicator tracks how many industrial accidents per 200,000 worker-hours (In-house & supplemental) result in lost work time, restricted work, or fatalities.
Misposition Events – rolling 18 mos.	<p>Number of misposition events. Mispositioned Component – Any positionable component found out of the expected position for existing plant conditions when the component’s required position is tracked by one or more of the following plant status control tools:</p> <ul style="list-style-type: none"> λ Procedures λ Tagouts λ Work Control Process λ Other similar authorizing documents

Trend Contributor or Predictor Indicators



Performance Measure	Description
Procedural Related Events - rolling 18 mos.	Procedure related events are seen in procedure/instruction use issues and are an indirect indicator of procedure quality. The measure shows the procedure error rate normalized to 10,000-work hours
Rework –rolling 18 mos.	<p>The re-performance of any physical maintenance task which results in a loss of time, labor, money, or other resources. The re-performance of any maintenance task prior to return to service. This includes failure of PM Runs and PMTs. The re-performance of any maintenance task, which is repeat maintenance, identical corrective action or an identical problem, which was performed within 12 months after return to service.</p> <p>The measure shows the rework rate per 10,000-person hours.</p>

Trend Contributor or Predictor Indicators



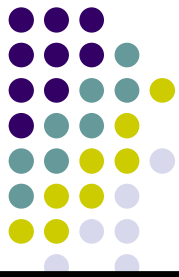
Performance Measure	Description
Nuclear Training related events	The number of plant events for which training was a causal factor (skills and knowledge) and is an indirect measure of training effectiveness. The measure shows the training related error rate per 10,000-person hours
Corrective Actions Overdue on the last day of the quarter	The total number of Corrective Actions that are overdue on the last day of the quarter.

Trend Contributor or Predictor Indicators



Performance Measure	Description
Corrective Action Extensions	The total number of extensions granted over the quarter.
Procedure Changes Backlog on the last day of the quarter	Backlog is measured as the total, open procedure revision requests on the last calendar day of the quarter_(multiple requests for one procedure should be counted as one change). (This could also be divided into administrative and technical procedures or divided by procedure cannot be used as written and procedure enhancement)

Trend Contributor or Predictor Indicators



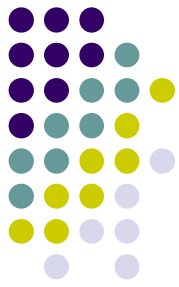
Performance Measure	Description
The Average age in months of the technical procedure backlogs. (NEI)	This is an indicator of the timeliness of procedure corrections, modifications, and enhancements.
Management Observations	The % of completed versus required observations performed by supervision each month. (derive from # or hours, etc..)

Trend Contributor or Predictor Indicators

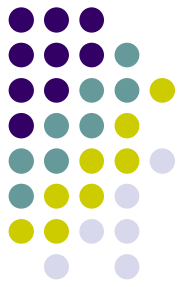


Performance Measure	Description
Training Observations for the quarter	The % of completed versus required observations performed by supervision for the quarter. (derive from # or hours, etc..)
Operator Work Arounds and deficiencies on the last day of the quarter	An Operator Work-Around/Operator Distraction is a deficiency in a policy, procedure, or component that adversely effects plant operations and causes operators to take compensatory actions. Number of Operator Work Arounds (non-outage and > 6 weeks old)

Trend Contributor or Predictor Indicators



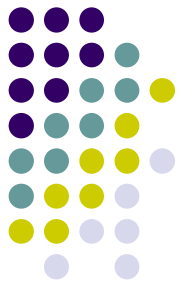
Performance Measure	Description
Corrective Maintenance Backlog on the last day of the quarter	Corrective maintenance is the classification of any work on power block systems, structures, or components (SSCs) where the SSC has failed or is significantly degraded to the point that failure is imminent (within its operating cycle/PM interval) and no longer conforms to or is incapable of performing the SSCs design function.



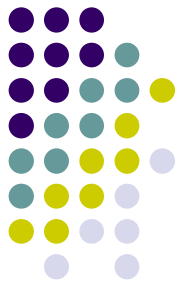
Use of Data

- λ Clock Resets Current Performance
- λ Clock Reset Trends
- λ Trend Contributors or Predictors
- λ Compare with the industry

Clock Resets Current Performance



- λ Days since last reset
- λ Average number of days between the last six resets
- λ Longest number of days between resets over the past 18 months



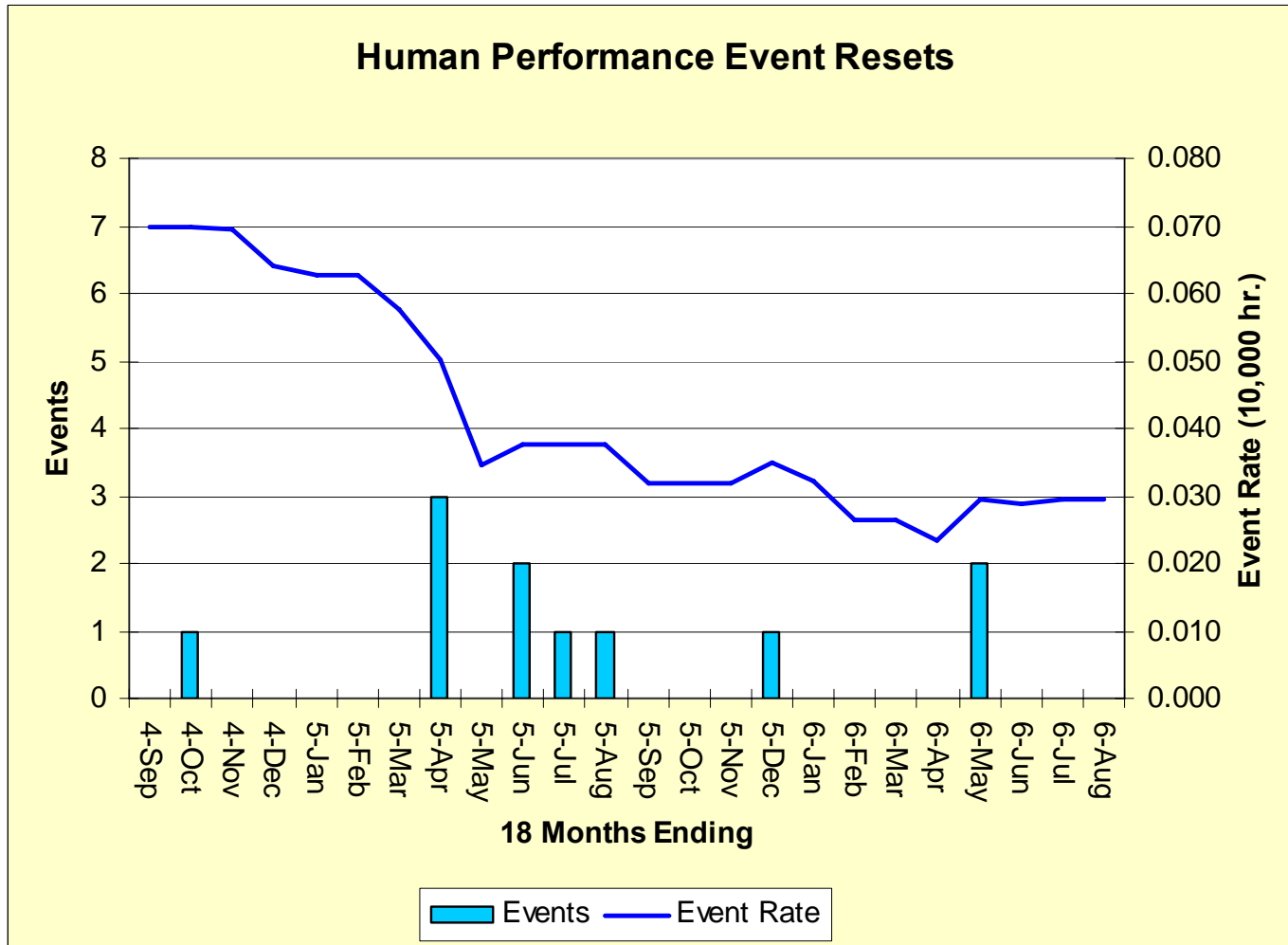
Clock Reset Trends

- λ What is the trend of the number of days between the last six resets?
- λ What is the trend in the event rate (the number of resets over the past 18 months normalized for work hours)?

Reset Trends



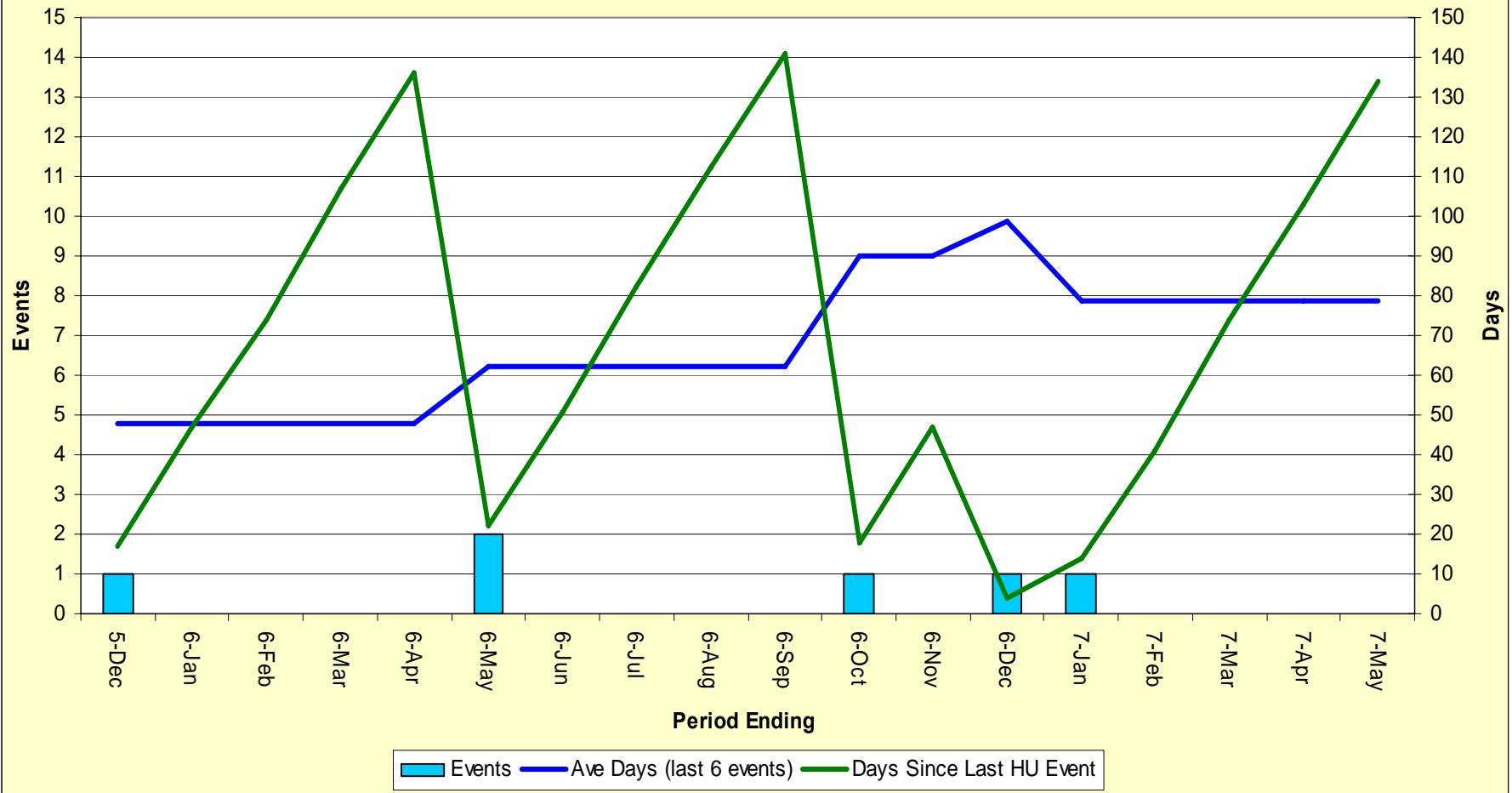
18 Month Human Performance Event Reset Rate Per 10,000 hours worked



Reset Trends



Human Performance Event Clock Resets
Days Since Last Event vs
Ave Days Between Last 6 Events



Trend Contributors or Predictors



- λ Trend other performance indicators to identify causes of resets.
- λ Trend other performance indicators to predict future resets and take corrective action.

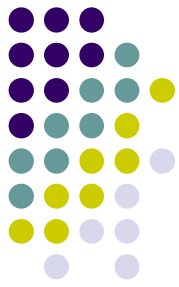
Compare To The Industry



λ Resets and Reset Trends

λ Contributor or Predictor Indicators

Communication



- λ Daily Meetings
- λ Video Streaming
- λ Stop Lights
- λ Red and Yellow Tail Board Documents
- λ Stand Downs
- λ Management Review Meetings

Event Rate

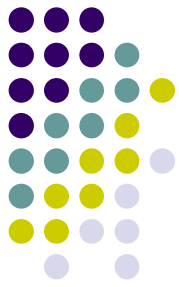
Plant Identifier	Time Frame			
	1st Qtr 06	2nd Qtr 06	3rd Qtr 06	4th Qtr 06
A	0.04	0.03	0.03	0.03
B	0.06	0.06	0.05	0.06
C	0.04	0.04	0.04	0.04
D	0.026	0.029	0.029	0.021
E				0.013
F		0.054	0.058	0.044
G		0.024	0.019	0.032
H	0.0405	0.0405	0.02	0.02
I	0.0241	0.02138	0.18	0.02
J	0.027	0.035	0.059	0.032
K	0.016	0.0191	0.0214	0.0281
L				0.03
M	0.014	0.014	0.012	0.011
N	0.039	0.047	0.042	0.042
O	0.022	0.019	0.015	0.02
P	0.028	0.037	0.033	0.038
Q	0.0358	0.0349	0.0347	0.0283

Event Rate

Time Frame

1st Qtr 06	2nd Qtr 06	3rd Qtr 06	4th Qtr 06
0.014	0.014	0.012	0.011
0.016	0.019	0.015	0.013
0.022	0.019	0.019	0.02
0.024	0.021	0.02	0.02
0.026	0.024	0.021	0.02
0.027	0.029	0.029	0.021
0.028	0.03	0.03	0.028
0.036	0.035	0.033	0.028
0.039	0.035	0.035	0.03
0.04	0.037	0.04	0.03
0.04	0.04	0.042	0.032
0.041	0.041	0.05	0.032
0.06	0.047	0.058	0.038
	0.054	0.059	0.04
	0.06	0.18	0.042
			0.044
			0.06

What's Next?



- λ Publish Good Practice
- λ Case Law



Questions?