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EPIX Usage Update

May 6, 2004

Glen Masters

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Scope

- Website Usage Levels
- Pattern Analysis Reports
  - Use
  - Description
  - Industry & INPO feedback
  - Ad hoc feedback

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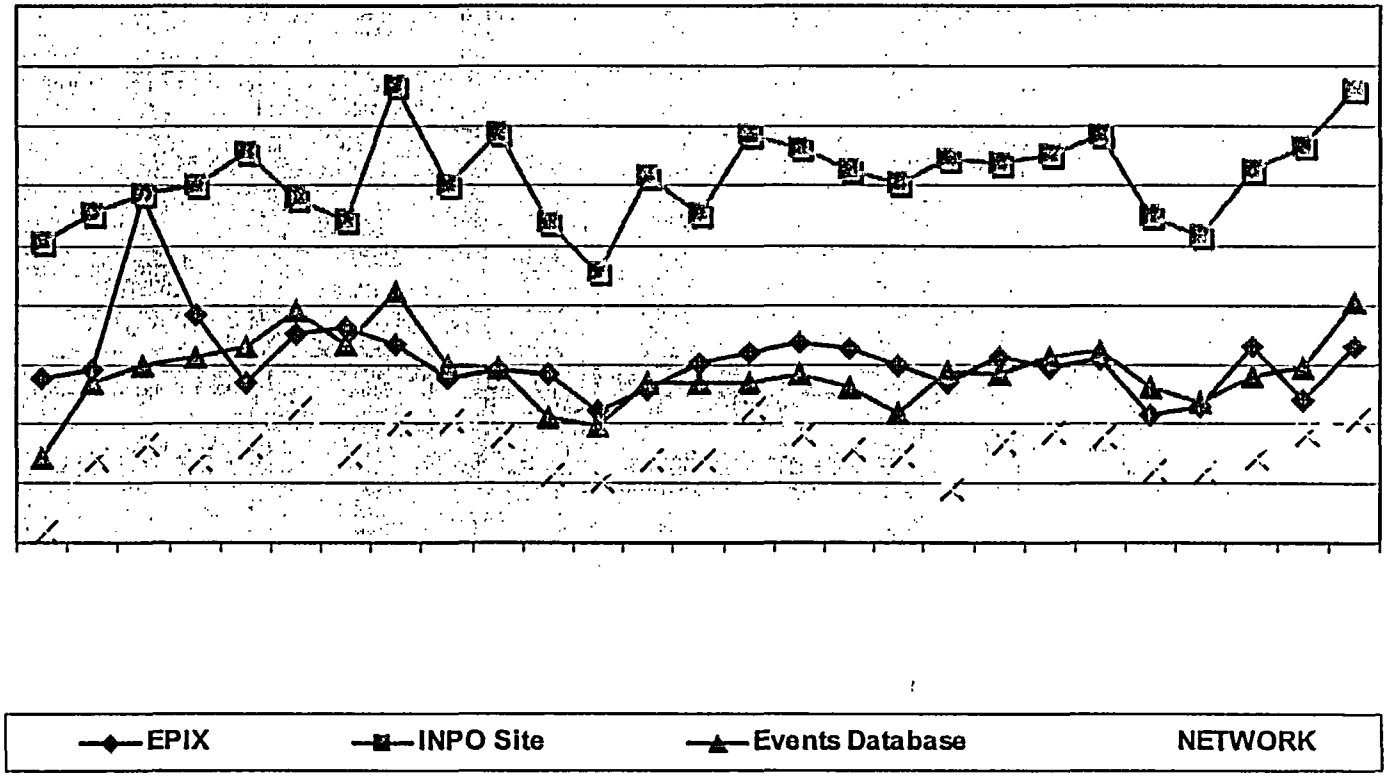
Website Usage



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Pattern Analysis Reports

- Industry/Fleet/Unit Analysis
- What are the predominant patterns of equipment failures ?
  - System
  - Component
  - Cause
- What are the adverse trends?

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Industry Pattern Analysis Use

- Input to cost/benefit analysis & business plans
- Identify problems obscured by organizational or other factors
- Validate self identified (top-ten) problem lists

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INPO Industry Performance Analysis

- INPO Analysis Initiatives
  - Has industry performance stalled?
  - What areas are costing the industry the most in trips/transients/lost generation?
- EPIX is preferred tool
  - Only available one that can do pattern analysis without extensive manual review
  - Can be directly cross-checked with ROP & MOR portions of CDE

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Eq. Performance Patterns

- Group of failure occurrences with something in common
- Historically based on AFI
  - Same system/component doesn't work – **Performance Pattern**
  - Same system/component/part breaks – **Breakage Pattern**
  - Same causal factor

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What Is "Same"?

- Common name (RCP, Feed Pump, etc.)
- Component type (valves)
- Component subtypes (AOV, MOV...)
- Manufacturer/Model/Part
- Cause (general and specific – human performance)
- Combos

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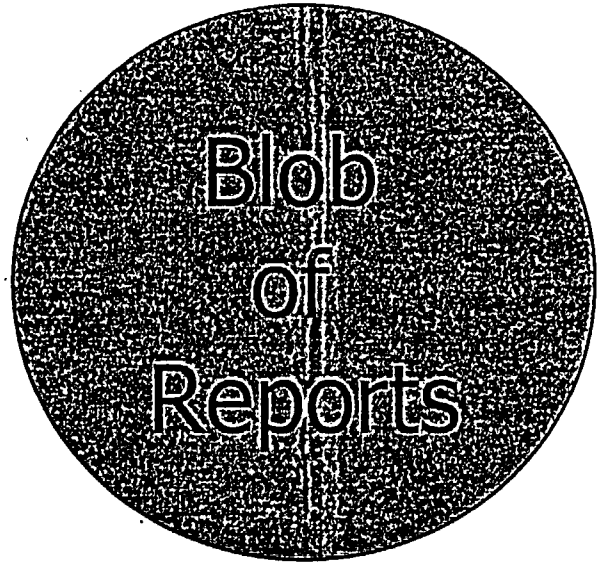
Most Significant Patterns



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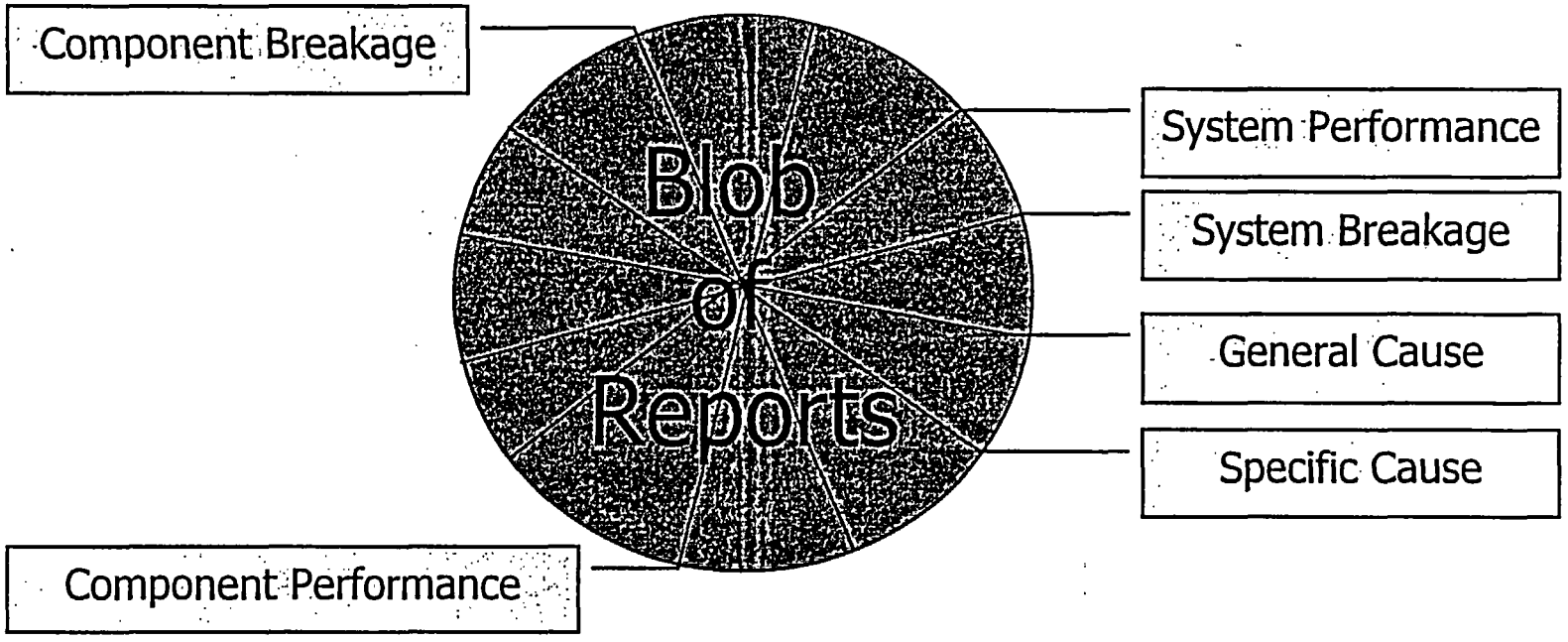
Cut By Pattern Types (42)



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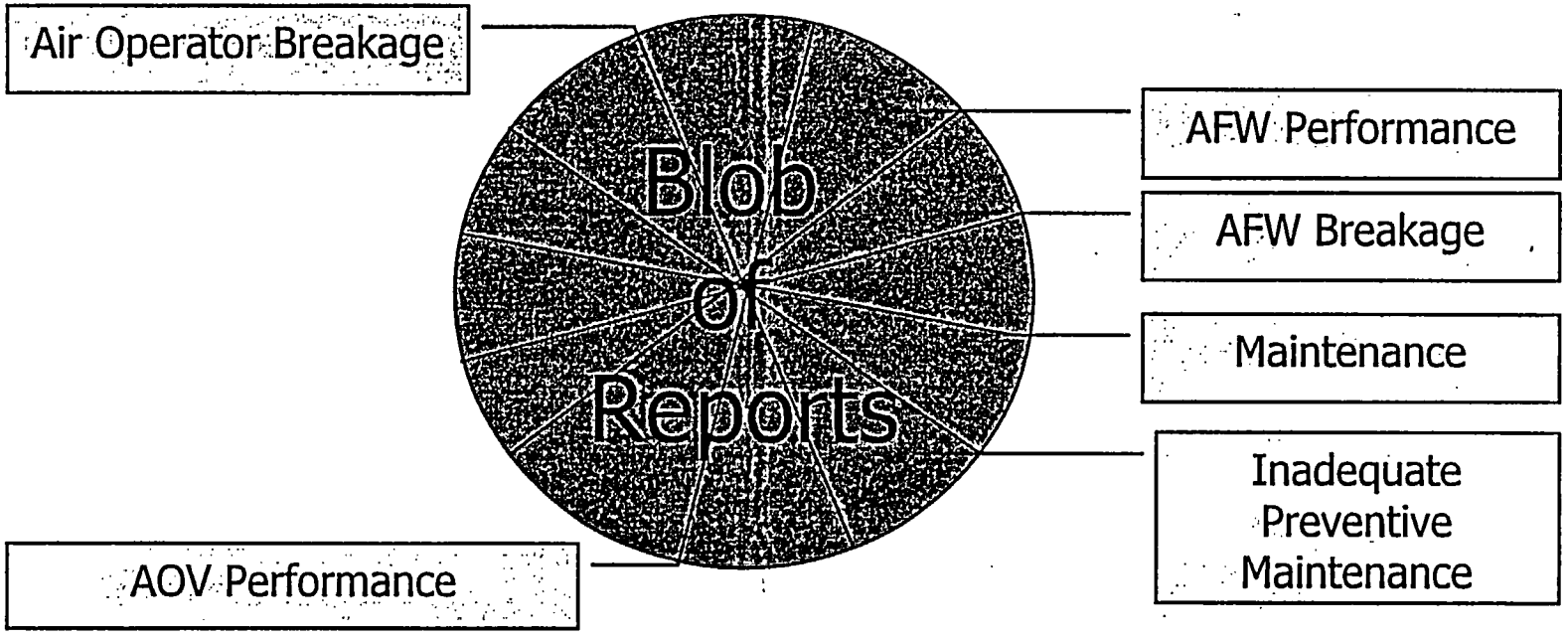
Yields Thousands of Specific Patterns – For Example



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Specific Pattern Significance – So What?

- Safety
  - Transients
  - Risk-significant equipment affected
- Reliability
  - MWhrs lost
  - Repeat maintenance

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Specific Pattern Significance Index

- Sum of four significance factors
  - Fraction of all failures occurring
  - Fraction of risk-significant equipment failures
  - Fraction of failures causing transients
  - Fraction of all MWhrs lost

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Specific Pattern Trend Detector

- Analysis Period
  - Two year moving window
  - Analyses for the previous 8 quarters at each point
- Adverse Trend (trending up-U)
  - Long term
  - Emerging

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Report Example

Performance	Significance		Failures	
Valves	0.78	U	1219	U
Circuit Bkrs	0.60	S/D	435	S/D
Pumps	0.45	U	135	U

Trending Up (U) or Steady/Declining (S/D)

Pattern Type Ordered by Significance Index (Max value 4)

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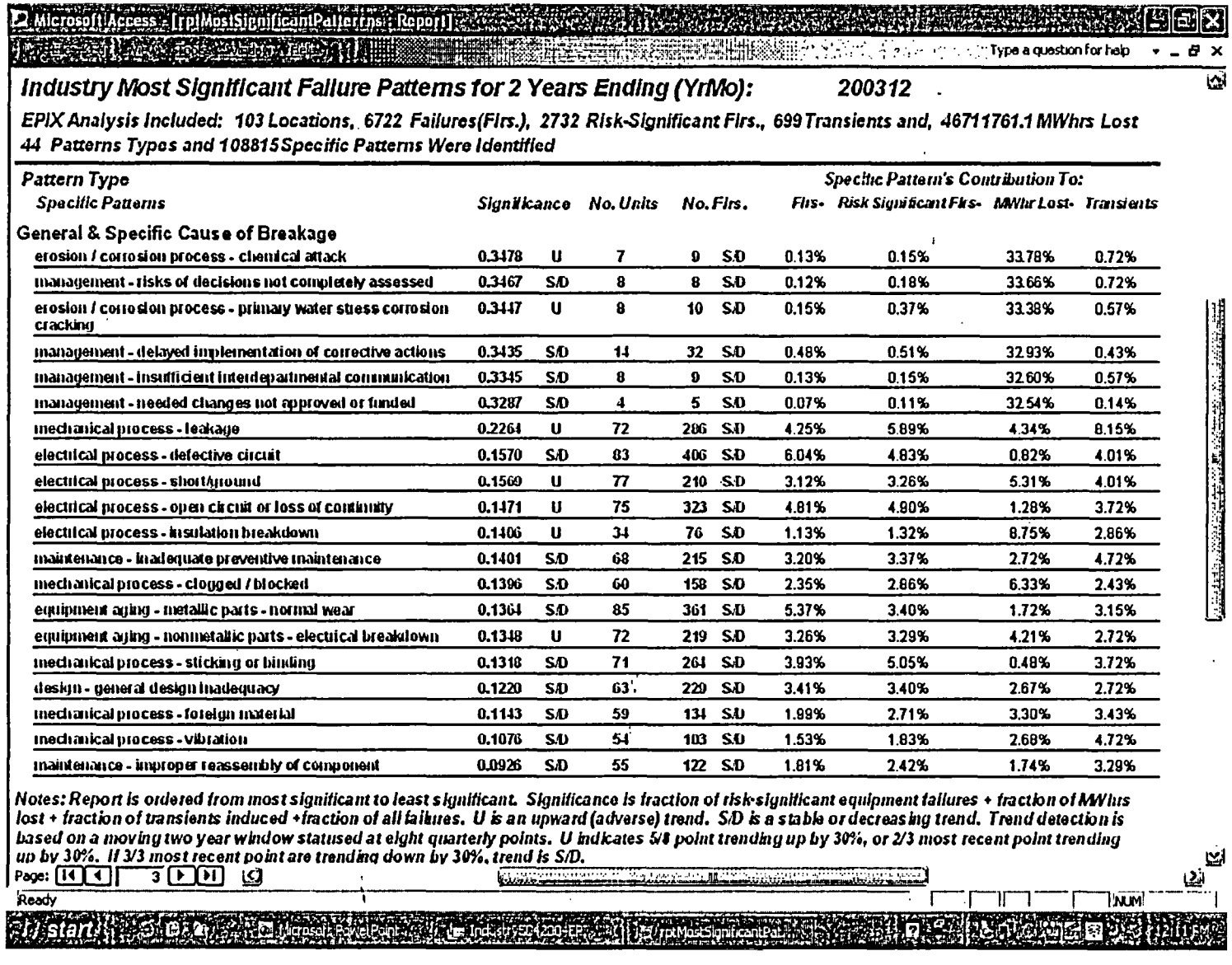

Microsoft Access - [rpt MostSignificantPatterns : Report]

Type a question for help

Industry Most Significant Failure Patterns for 2 Years Ending (YrMo): 200312

EPIX Analysis Included: 103 Locations, 6722 Failures(Flrs.), 2732 Risk-Significant Flrs., 699 Transients and, 46711761.1 MWhrs Lost
44 Patterns Types and 108815 Specific Patterns Were Identified

Pattern Type / Specific Patterns	Significance		No. Units	No. Flrs.		Specific Pattern's Contribution To: Flrs.	Risk Significant Flrs.	MWhr Lost	Transients
General & Specific Cause of Breakage									
erosion / corrosion process - chemical attack	0.3478	U	7	9	S/D	0.13%	0.15%	33.78%	0.72%
management - risks of decisions not completely assessed	0.3467	S/D	8	8	S/D	0.12%	0.18%	33.66%	0.72%
erosion / corrosion process - primary water stress corrosion cracking	0.3447	U	8	10	S/D	0.15%	0.37%	33.38%	0.57%
management - delayed implementation of corrective actions	0.3435	S/D	14	32	S/D	0.48%	0.51%	32.93%	0.43%
management - insufficient interdepartmental communication	0.3345	S/D	8	9	S/D	0.13%	0.15%	32.60%	0.57%
management - needed changes not approved or funded	0.3287	S/D	4	5	S/D	0.07%	0.11%	32.54%	0.14%
mechanical process - leakage	0.2264	U	72	286	S/D	4.25%	5.89%	4.34%	8.15%
electrical process - defective circuit	0.1570	S/D	83	406	S/D	6.04%	4.83%	0.82%	4.01%
electrical process - short/ground	0.1569	U	77	210	S/D	3.12%	3.26%	5.31%	4.01%
electrical process - open circuit or loss of continuity	0.1471	U	75	323	S/D	4.81%	4.90%	1.28%	3.72%
electrical process - insulation breakdown	0.1406	U	34	76	S/D	1.13%	1.32%	8.75%	2.86%
maintenance - inadequate preventive maintenance	0.1401	S/D	68	215	S/D	3.20%	3.37%	2.72%	4.72%
mechanical process - clogged / blocked	0.1396	S/D	60	158	S/D	2.35%	2.86%	6.33%	2.43%
equipment aging - metallic parts - normal wear	0.1364	S/D	85	361	S/D	5.37%	3.40%	1.72%	3.15%
equipment aging - nonmetallic parts - electrical breakdown	0.1348	U	72	219	S/D	3.26%	3.29%	4.21%	2.72%
mechanical process - sticking or binding	0.1318	S/D	71	264	S/D	3.93%	5.05%	0.48%	3.72%
design - general design inadequacy	0.1220	S/D	63	229	S/D	3.41%	3.40%	2.67%	2.72%
mechanical process - foreign material	0.1143	S/D	59	134	S/D	1.99%	2.71%	3.30%	3.43%
mechanical process - vibration	0.1076	S/D	54	103	S/D	1.53%	1.83%	2.68%	4.72%
maintenance - improper reassembly of component	0.0926	S/D	55	122	S/D	1.81%	2.42%	1.74%	3.29%

Notes: Report is ordered from most significant to least significant. Significance is fraction of risk-significant equipment failures + fraction of MWhrs lost + fraction of transients induced +fraction of all failures. U is an upward (adverse) trend. S/D is a stable or decreasing trend. Trend detection is based on a moving two year window statused at eight quarterly points. U indicates 5/8 point trending up by 30%, or 2/3 most recent point trending up by 30%. If 3/3 most recent point are trending down by 30%, trend is S/D.

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Ready

NUM

start

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Engineering Supervisors Professional Development Seminars(6) Feedback

- Provides a unique and valuable analysis capability not available at many member plants
- Data reporting not complete enough at a some of sites to yield credible results
- Need to express factor fractions as percents
- Needs a "drill down" capability

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INPO Equipment Performance and Analysis Department Feedback

- Needs a "drill down" analysis capability
- Some major events are mischaracterized
- Some major events are not reported
- May have too rich a set of pattern types (some are redundant)
- Significance factors may need to be changed

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Other Management Feedback

- Needs to identify improving as well as adverse trends
- Format looks too complexed, needs a summary or rollup

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Drill Down Capability

- Requested by INPO Analysis Dept.
- Requested by ESPDS
- ACCESS® prototype in testing
- Demonstration

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Questions for Ad hoc Feedback

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Is Two Years the Right Window?

- Two years includes at least one refueling
- Corresponds with Plant Information Center
- WANO/ROP use 3 years for equipment performance

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Are the Significance Factors Correct?

- Currently
  - Fraction of all failures occurring
  - Fraction of risk-significant eq. failures
  - Fraction of failures causing transients
  - Fraction of all MWhrs lost
- Possibly
  - Fraction of automatic/manual/all scrams
  - Fraction of unplanned/planned MWhrs lost
  - Fraction of unavailable hours
  - Fraction of units affected
  - other

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Are the Pattern Types Correct?

- Which can be dropped
- Should we add?
  - System-component
  - System-component-general cause
  - System-component-general & specific cause
  - System-component subtype-cause
  - System-component-general & specific cause
  - Other

Redundant Specific Patterns

- Multiple specific patterns may consist of the same *n* reports
- Should we
  - Ignore it and present all specific patterns?
  - Filter out more detailed specific patterns that are covered by more general specific patterns?

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Unit Common Failures

- Currently
  - Counted against all units at station
  - Small number of events (32 in last 2 years)
- Other alternatives?

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Single Event Saturation of Results

- Single large events saturate results for a window before & after
- What do we need to do?
  - Ignore it, it reflects reality
  - Cap MWhrs from any one event
  - Exclude selected events
  - Other

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MWhrs For Continuing Events

- Currently not accounted for
- Possibilities
  - If failure end date is blank, use plant rating x hours since discovery for trips/shutdowns
  - If MWHrs is blank, use plant rating x hours between discovery and failure end for trips/shutdowns

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Format Improvements?

- How do we improve readability?
- How make it look less complexed?
- Do we apply a significance cutoff?
- Do we apply a number of failures cutoff?
- How do we make a summary?

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Should We Include?

- Improving as well as adverse trend identification
- Significance outlier information (this is a worst problem here than at peer plants)
- Failure probability outlier information (CFAR replacement)

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Performance Analysis Problems

- There is an increasing demand for this type of analysis with short lead times
- High stakes analysis requires high quality, reasonably complete data
- A single misreported/omitted large event can skew the results
- Examine details in the Data Update

Attachment 4

UPDATE ON NRC USAGE OF EPIX DATA

BENNETT M. BRADY (301-415-6363, bmb1@nrc.gov)
OPERATING EXPERIENCE RISK ANALYSIS BRANCH
OFFICE OF NUCLEAR REGULATORY RESEARCH
U.S. NUCLEAR REGULATORY COMMISSION

Presentation for EPIX Ad hoc Working Group

MAY 6, 2004

CONTINUED USE OF EPIX DATA IN REGULATORY PROGRAMS

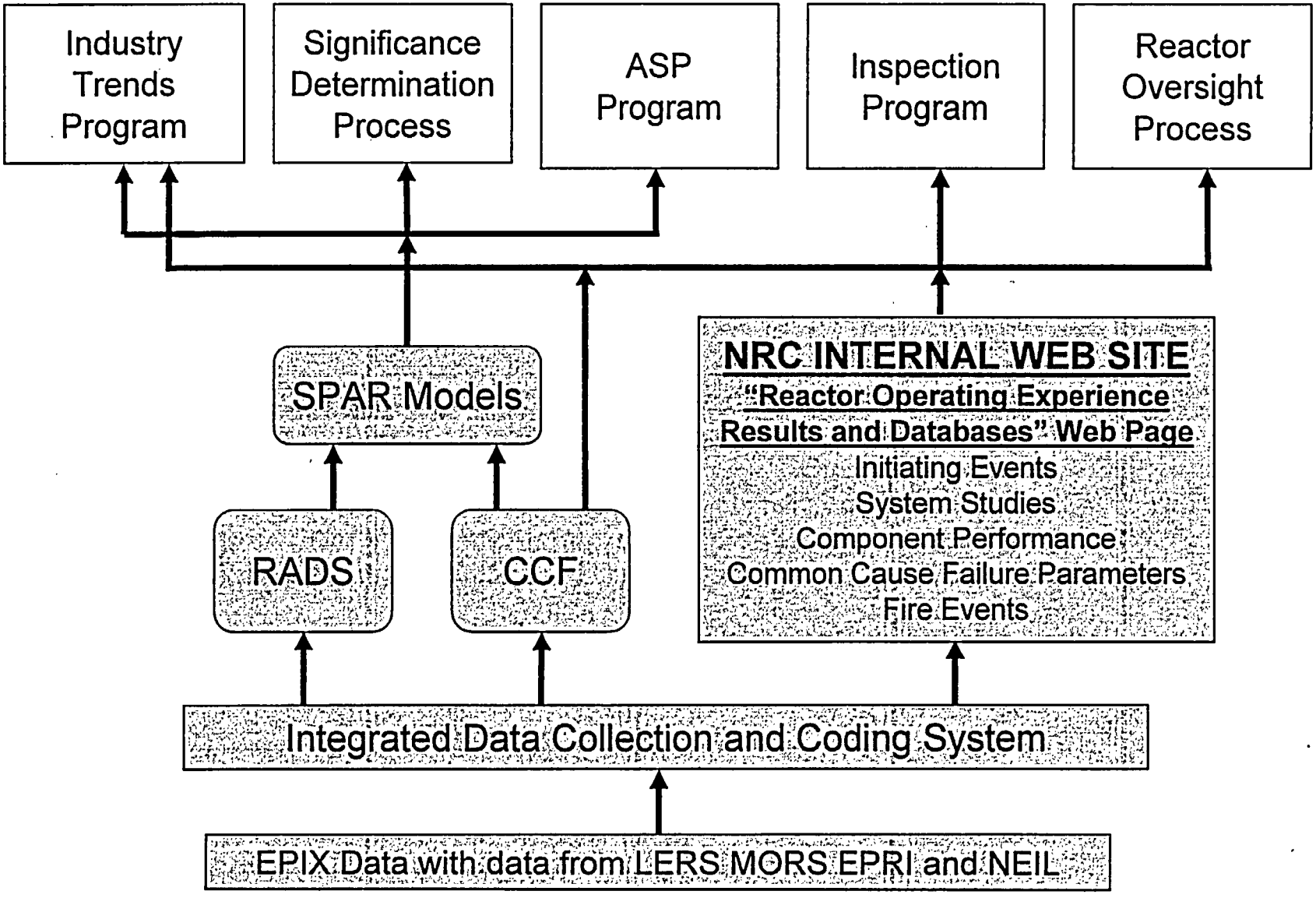
- EPIX data provide input into NRC databases
  - Reliability and Availability Data System (RADS)
  - Integrated Data Collection and Coding System
  - Common-Cause Failure Database (CCFDB)

- RADS and CCFDB provide PRA parameter estimates for SPAR models

- SPAR Models and RADS data used in
  - Industry Trends Program
  - Significance Determination Process
  - ASP Program
  - Inspection Program
  - Indicator Development for ROP

EPIX DATA IN THE NRC REGULATORY PROCESS

Regulatory Programs



EXPANDED USE OF EPIX DATA

- SPAR Models
  - EPIX/RADS data will be used to estimate more up-to-date component failure probabilities and failure rates for SPAR models
- RADS
  - Number of risk-significant components being expanded from about 20 to about 40
  - New component types being added to support SPAR models include
    - Chillers
    - Check valves
    - Circuit breakers
    - Gas turbine generators
    - Electrical fans