

Safety Culture Traits Validation in Power Reactors

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Why Include this Study in the Discussion?

- Most formulations of safety culture (IAEA, NRC, INPO) were created by a small group of 'experts'
- This is an attempt to incorporate 'data' into the discussion of the language used to describe safety culture

Limitations of the Study

- Only power reactors
- Correlational; not predictive

Questions of the Study

- How well do the factors from a safety culture survey align with the safety culture traits that were identified during the Feb 2010 workshop?
- Do the factors relate to other measures of safety performance?

Survey Development

- Started with the Utility Service Alliance survey based upon INPO's Principles for a Strong Nuclear Safety Culture (73 items)
- Edited and added questions to accommodate workshop Traits
- NRC reviewed and suggested edits and additional items based on Traits, IAEA, ROP, and literature
- Final version was 110 items with 7-point scale (strongly disagree to strongly agree w/ Don't Know)

Example Questions

- People are treated with dignity and respect by station leadership
- We have a strong quality assurance process and organization
- Our performance indicators help us to stay focused on the 'right things'
- The procedures at this site are generally up-to-date and easy to use
- Staffing levels are adequate to meet work demands

Example Questions

- At this station, people are routinely rewarded for identifying and reporting nuclear safety issues
- Dialogue and debate are encouraged when evaluating nuclear safety issues
- I would not hesitate to take a concern to our Employee Concerns Program
- Decision-making at this site reflects a conservative approach to nuclear safety
- Supervisors are responsive to employee questions

Survey Administration

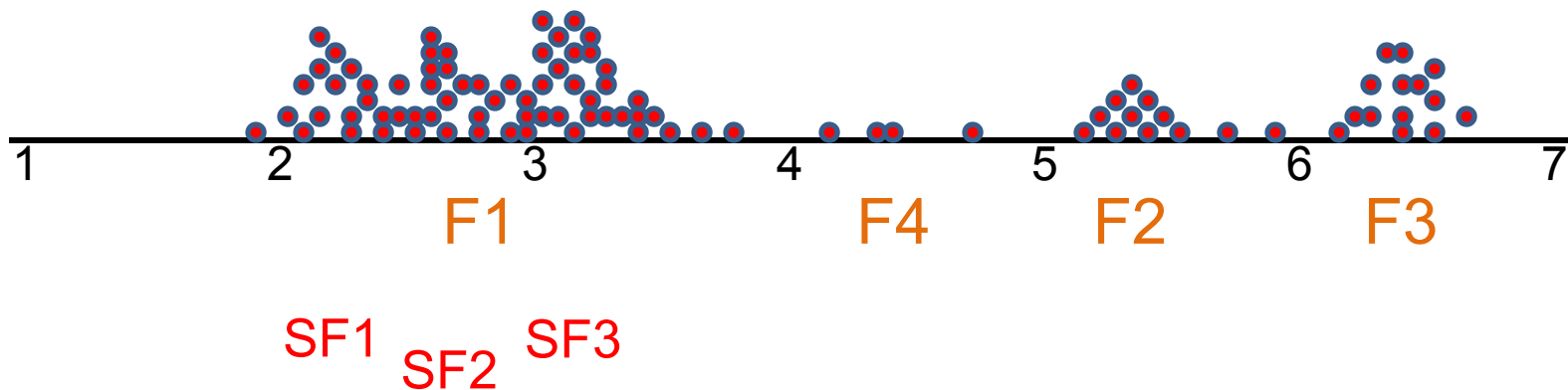
- Online survey
- Randomly selected sample of 100 personnel from each site
- 63 nuclear reactor sites (97%)
- An average of 46 individuals participated from each site
- 2,876 individuals provided valid responses to the majority of items

Survey Analysis

- Principal Components Analysis performed to identify the “factors” within the data
- Brief, non-mathematical explanation of PCA (with apologies to psychometricians and statisticians)

PCA/Factor Analysis

- Need: to reduce the set of variables (items) in a dataset
 - Eyeball analysis
 - PCA/Factor analysis



Survey Results

1. Management Responsibility
 - Respectful Work Environment
 - Continuous Improvement
 - Performance Indicators
 - Resources
 - Rewards
2. Willingness to Raise Concerns
 - Informally
 - Formally

Results

3. Decision Making

- Decisions are conservative, timely, safety-focused, and engender confidence

4. Supervisor Responsibility

- Communication
- Presence/Availability
- Coaching
- Management Alignment

Results

5. Questioning Attitude

- Situation/Problem Awareness
- Process Use
- Plant Knowledge

6. Safety Communication

- Safety communication is broad and includes plant-level communication, job-related communication, worker-level communication, equipment labeling, operating experience, and documentation

Results

7. Personal Responsibility

- It is my responsibility to report concerns and practice nuclear safety

8. Prioritizing Safety

- Nuclear safety is a priority that is seen in meetings, expectations, coaching, and decisions

9. Training Quality

- Training is high quality, supported by management and encourages nuclear safety

Factors vs. Traits

Survey Factors	Workshop Traits
Management Responsibility for Safety	Leadership Safety Behaviors
Respectful work environment	Respectful Work Environment
Continuous improvement Performance Indicators	Problem Resolution and Metrics, Continuous Learning
Willingness to Raise Concerns	Encouraging Report of Problems
Supervisor Responsibility for Safety	
Questioning Attitude	
Procedure Use	Processes and Procedures
Communication	Effective Safety Communication
Personal Responsibility for Safety	Personal Responsibility and Attitudes
Decision Making	
Prioritizing Safety	
Training Quality	

Factors, Traits, Principles, & ROP

Survey Factors	Workshop Traits	INPO Principles	ROP Components *
Management Responsibility	Leader Safety Respect Work Environment Problem Res & Metrics Continuous Learning	2. Leader Demonstrates 3. Trust Permeates 7. Org Learning 8. Nuc Under Cons Exam	2. Resources 5. CAP 6. OE 7. Self & Ind Assessment 8. Environ Rais Concerns 10. Accountability 11. Cont Learn Environ 12. Org Change Mgt
Supervisor Responsibility			
Personal Responsibility	Personal Accountability	1. Everyone Personally Responsible	
Decision Making		4. Decision Making Reflects Safety First	1. Decision Making
Communication	Effective Safety Comm		3. Work Control
Training Quality			
Questioning Attitude	Work Processes	6. Ques Att is Cultivated 5. Nuc Tech Unique	
Willingness to Raise Concerns	Environment for Raising Concerns		9. Preventing Retaliation
Prioritizing Safety			13. Safety Policies

* 4. Work Practices too broad to categorize

Do the factors relate to other measures of safety performance?

- Calculated correlations of the factor (and subfactor) for each site with INPO and NRC measures related to safety culture/organizational effectiveness and equipment performance
- Average correlations in previous meta-analyses were .22 and .31 (Clarke, 2006; Christian, et al, 2009)

Factor-Specific Validities *

Factor	ROP	Unpln Crit Scram	Unpln Auto Scram	Heat Remo Avail	Em Pwr Aval	Per Safe Idx	CY Indx	HU Err Rate
Mgt Respon	.30	.29	.34	.18	.26 (.31)	.23 (.31)	.27 (.39)	.38
Raising Concerns	.25	.17	.24	.19	.27	.22	.22	.37
Decision Making	.32	.28	.38	.22	.24	.25	.28	.36
Sup Respon	.28 (.35)	.15	.22 (.40)	.35	.30	.19	.14 (.32)	.40
Ques Attitude	.18	.27	.26 (.44)	.16	.37	.32	.26 (.32)	.28
Safety Comm	.20	.32	.34	.16	.27	.27	.28	.39
Personal Respon	.05	.16	.21	.20	.14	.25	.27	.21
Prioritizing Safety	.21	.24	.30	.23	.17	.22	.21	.25
Training	.12	.33	.40	.14	.15	.13	.30	.19

* Selected subfactor scores in brackets

General Conclusions

- Results support the existence of the workshop traits, however in a slightly different configuration
- Factors are consistent with research in other domains
- Survey factors are related to other measures of organizational effectiveness and equipment performance in nuclear power plants