Trusted AI Decision Intelligence Support for Nuclear Material Accountability and Control

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COGILITY SOFTWARE

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The Human-Centric Challenge

Despite major investments in technical safeguards, nuclear MC&A programs remain vulnerable to human-centric risks that evade early detection.

Information Theft

Unauthorized access to sensitive nuclear data

Material Diversion

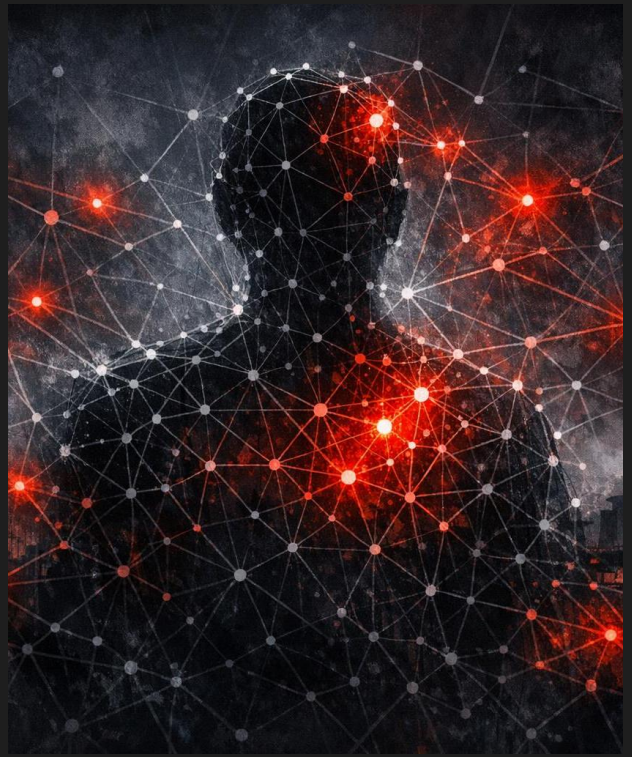
Theft or misrouting of nuclear materials

Sabotage

Deliberate damage to systems or processes

Unintentional Errors

Human mistakes with safety consequences



The Stakes: Insider Risk by the Numbers

$14.45M

Average cost per malicious insider incident in energy sector

Seewald, 2023

- Insider incidents rising across energy domains, both negligent and malicious
- Mixed workforces (employees, contractors, vendors) increase exposure
- Standard awareness training fails to produce durable behavioral change
- Nuclear operations face uniquely severe cyber-physical consequences

Expanding digital attack surfaces + workforce volatility = growing insider compromise opportunity

Illustrative Cases: Behavioral Risk Patterns

These incidents highlight gaps in continuous evaluation, psychosocial screening, and cross-functional indicator tracking.

Psychosocial Crisis

SL-1 Reactor explosion
1961

- *Stress*
- *Performance Issues*
- *Interpersonal Issues*

Disgruntlement

San Onofre diesel generator sabotage
2012

- *Grievances*
- *Perceived Unfairness*
- *Low Morale*

Financial Gain

Ecclestone Case / NRC & DOE
2013

- *Data exploitation/ Espionage for Financial Gain*
- *Privilege Misuse*

Decision Intelligence & Expert AI Analytics

Fusing behavioral science, cyber-physical signals, and organizational context into explainable, auditable decision support.

Technical Activity Monitoring

UEBA with personalized baselines for anomaly detection in access, timing, and data movement

Psychosocial / Behavioral Indicators

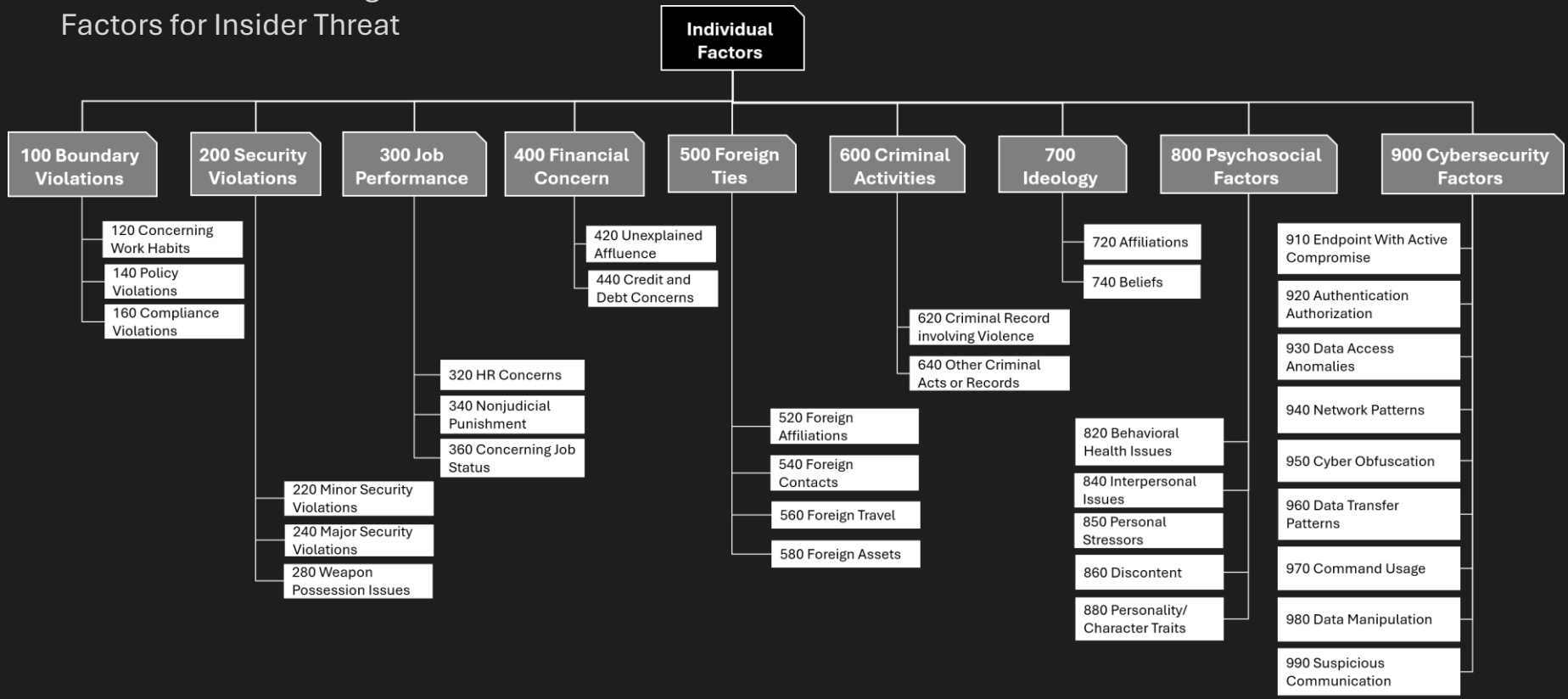
Behavioral science to anticipate noncompliance precursors and psychosocial risk

Organizational Factors

Security climate, reporting norms, and governance that shape risk expression

SOFIT Taxonomy: Individual Factors Branch

Sociotechnical and Organizational Factors for Insider Threat



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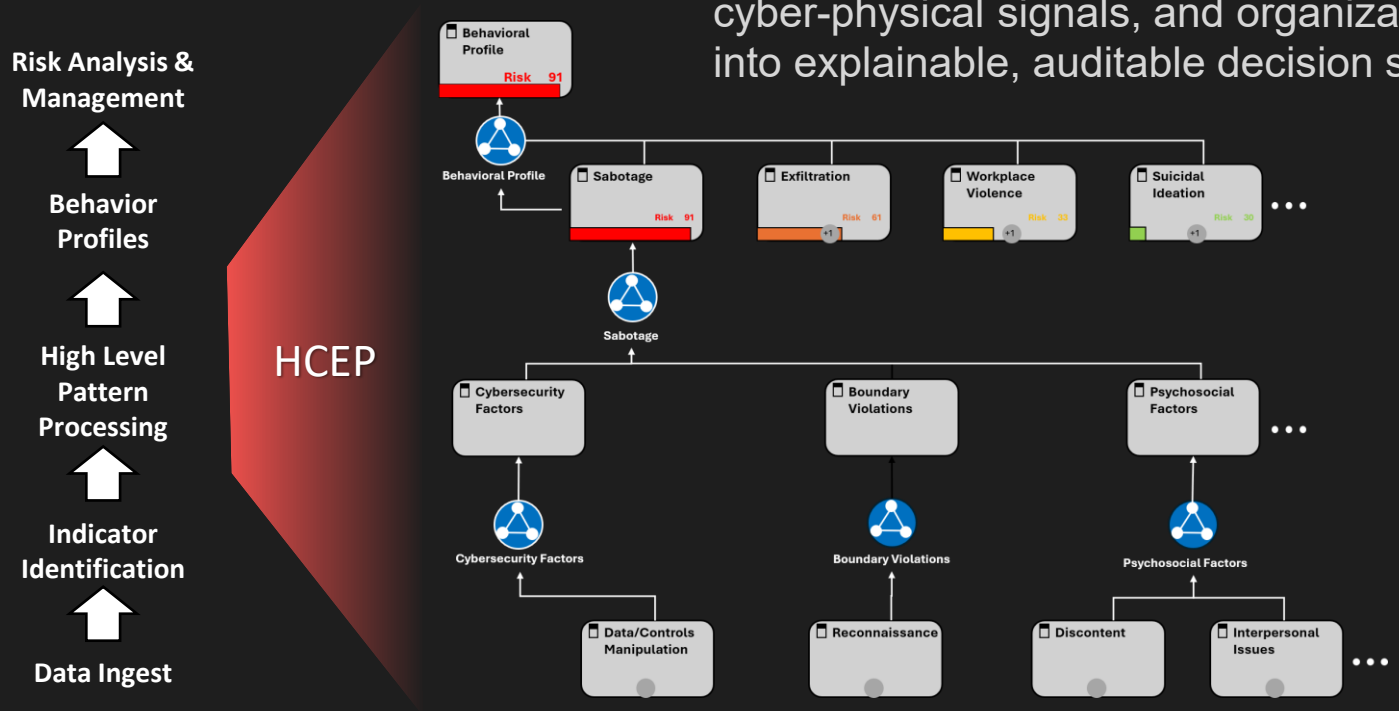
Cogynt.ai Hierarchical Complex Event Processing (HCEP)

The **HCEP** framework fuses behavioral science, cyber-physical signals, and organizational context into explainable, auditable decision support.



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Performance Evaluation: Cogynt.ai

Validation study comparing tool performance with expert judgments:

ROC analysis shows **Cogynt.ai** superior performance…

Metrics:

- True Positive rate
- False Positive rate
- False Negative rate
- F1 score (harmonic mean of Precision and Recall)

- Counting Model

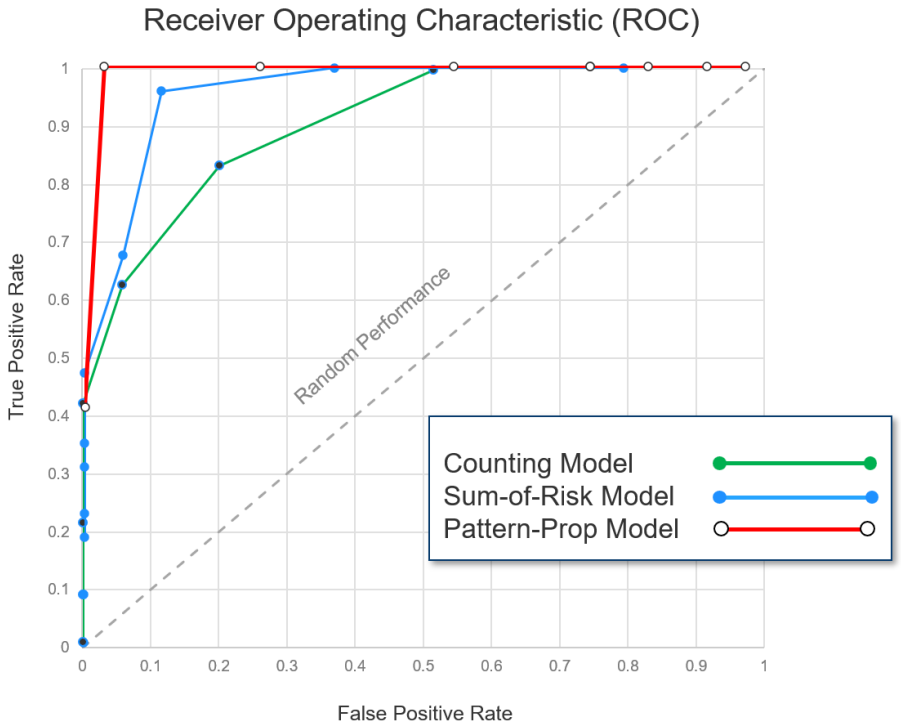
Precision	0.74
Recall (Hit or True Positive)	0.83
FP rate	0.20
FN rate	0.17
F1	0.78

- Sum-of-Risk Model

Precision	0.85
Recall (Hit or True Positive)	0.96
FP rate	0.11
FN rate	0.04
F1	0.90

- Cogynt Model

Precision	0.96
Recall (Hit or True Positive)	1.00
FP rate	0.03
FN rate	0.00
F1	0.98



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Conclusions

Key Benefits of This Approach:

Early Detection	Analyze patterns of behavioral and technical indicators to identify MC&A risks before incidents occur
Reduced False Positives	Align anomalies with roles, workloads, and operational context for accurate alerting
Strengthened Security Culture	Emphasize intrinsic motivation and psychologically safe reporting environments
Cross-Functional Collaboration	Whole-person risk visibility through integrated governance and information sharing
Regulatory Alignment	Align with evolving international best practices on human-centric cybersecurity and MC&A

Thank You

Lightning Talk:

Trusted AI Decision Intelligence Support for Nuclear Material Accountability and Control

Related INMM Presentations:
Monday Aug 3 Presentation 12A:
"Behavioral Analytic Modeling"
1:40-2:00 PM Lone Star Ballroom F

Monday Aug 3 POSTER SESSION 17:
3:50-5:10 PM Griffin Hall

Wednesday Aug 5 PANEL 53
"Catch Me If You Can"
10:45-12:25 Lone Star Ballroom H

Full references available in the INMM proceedings

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Download the Paper

Related INMM Material (in *Proceedings*):

Greitzer, FL & Noonan, CF. (2026). Behavioral Analytic Modeling for Insider Threat Assessment & Mitigation in the Nuclear Power Industry. *INMM 2026 Proceedings*.
Greitzer, FL. (2026). Trusted AI Decision Intelligence Support for Nuclear Material Accountability and Control. *INMM 2026 Proceedings*.

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