Understanding Process Safety Events Using Advanced Data Analytics



September 2022 Nyala Noë (Senior Data Scientist) Empirisys





Client X

A leader in the global chemical industry with a diverse range of products with regional HQs in America, Europe, and Asia

Empirisys

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Fast-growing start-up established in 2020

Combines data science with operational engineering expertise Founded by Gus Carroll and Peter Sueref



50+ Chemical sites



30+ Countries



Fortune 500 Most Admired Company

Our Approaches



Data Science





Leadership Development



Technical Consulting

Our Target Sectors



Renewables



Chemicals & Refining



Oil & Gas

Basis of Proof of Concept



INTENT Evaluate potential for data mining of

operational data to provide insight into preventing process safety events SCOPE

3 polymer manufacturing facilities Focus on using:

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- Incident data
- Maintenance data

Key questions:

- 1. Is there a relationship between maintenance and incident data
- 2. Can the timing of maintenance activity give insights into incidents
- 3. Can recurring descriptors in maintenance work orders be used to identify future incidents

POC data analysis using:

- Statistical analysis
- Time-series analysis
- Natural language processing



Data Science Project Cycle



Combining Maintenance and Incident





Constructing the event timeline





Initial Findings



Equipment involved in Process Safety Events

Breakdown Maintenance Activity



Key Conclusion 1

This is the pattern of maintenance work orders at equipment with **No Events**

This is what actually happens at equipment with **Process Safety Events**

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Key Conclusion 2

Correlation = Number of Incidents X Number of Breakdowns



Preliminary Conclusions from PoC





There are more breakdown and fewer preventative work orders at equipment with PS events



Some events show a correlation with same and prior month breakdown maintenance activities

These key conclusions appear to demonstrate the presence of potential process safety "weak signals" and may form the basis of a useful PSE leading indicator



Benefits of the Partnership



Showed some promising links between maintenance and events that needs further investigation



Showed the benefits of data science insight to complement incident analysis by subject matter experts



Successful partnership between Company X and Empirisys teams





Next steps



Thank you

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Expected Values (Explanation)

Actual	Group A	Group B
Type I	10	20
Type II	5	40

Ехр	Group A	Group B
Type I	6	24
Type II	9	36

	Group A	Group B	Col total
Type I	10	20	30
Type II	5	40	45
Row total	15	60	75

Expected Value = Row Total x Column Total / Grand Total