



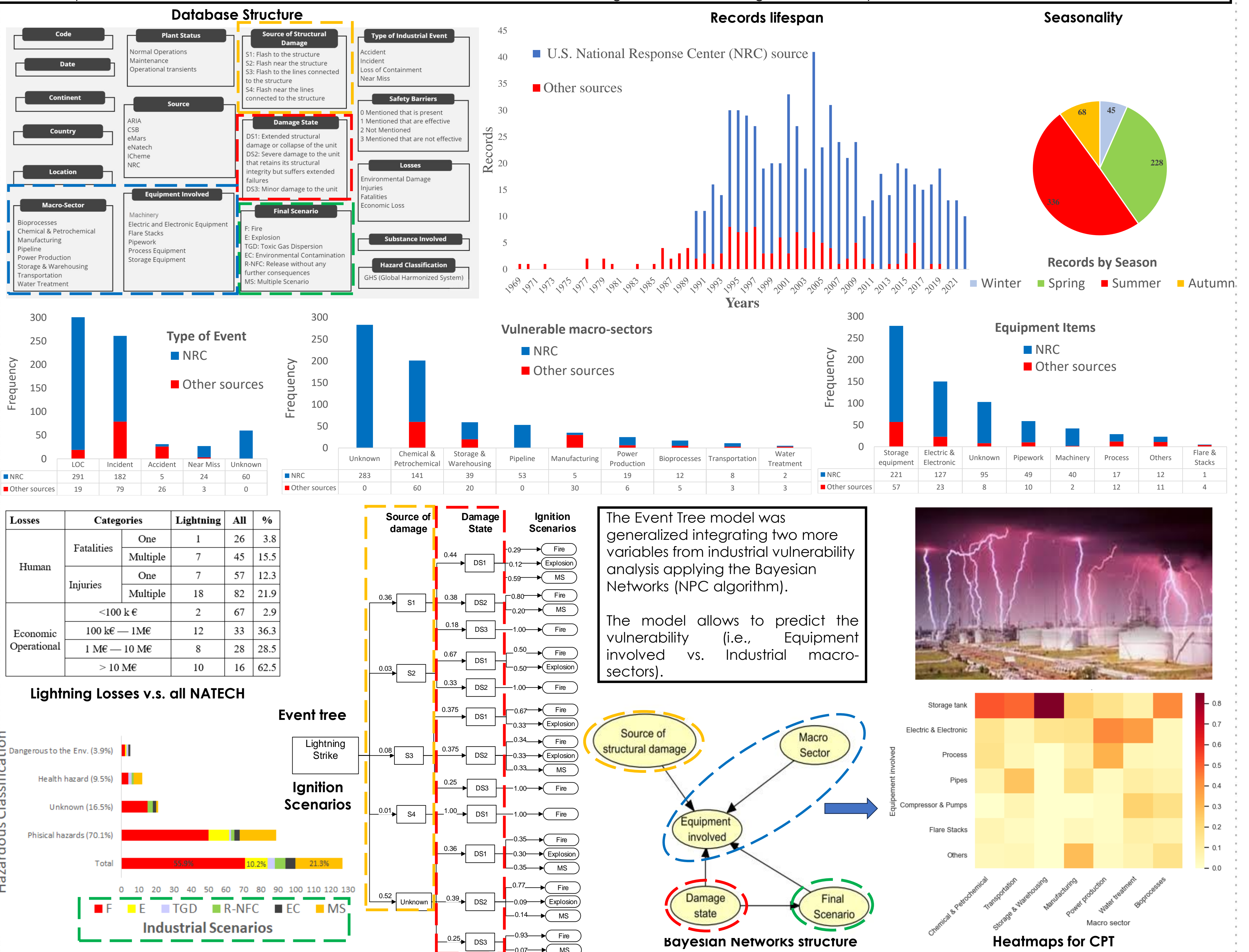
# Sustainability of Process Industry: The Elements of Natech Events Triggered by Lightnings.

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**Abstract:** Lightning strikes, a prominent meteorological event, pose a significant risk of triggering technological disruptions (Natech) within the process industry. To understand better this phenomena, an analysis focused on past lightning-triggered events was carried out, examining open-source industrial accident databases to compile a dataset of 689 records. Quantitative analysis unveiled that over 80% of these events were Incidents and Loss of Containment. Notably, 83.3% of these events occurred during spring and summer, indicating a seasonal pattern. Vulnerability was highest in the Chemical and Petrochemical sector, followed by Storage and Warehousing. Storage equipment accumulated about 40% of the events, followed by electric equipment and electronic devices at 21%. Fire scenarios predominated at 56%. Roughly 70% of triggered scenarios involved substances classified as physical hazards according to GHS. Event tree analysis indicated that direct industrial structure impacts accounted for 36%, while an indirect pathway contributed to 12% of classifiable records. Bayesian network analysis enabled the derivation of conditional probabilities for final scenarios based on equipment and macro-sectors. Estimated losses underscored the adverse consequences of lightning-triggered Natech events, highlighting their major impact affecting both the safety and the environment. The results are relevant in the context of climate change where meteorological events may become more critical.



**Conclusions:** Data analysis allows learning from past industrial accidents and identifying vulnerability patterns based on conditional probabilities tables (CPT), that link the source of lightning strikes, extent of damage, industrial macro-sectors, vulnerable assets, and final scenarios. The seasonal patterns show that 83.3% of these events occurred in the spring and summer, providing valuable insight for proactive lightning protection system inspections and protection of vulnerable assets. It is important to pay particular attention to the expected increase in frequency and severity of this meteorological Natech factor due to climate change. Overall, this research highlights the importance of managing NaTech events in the context of climate change adaptation and industrial safety.

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