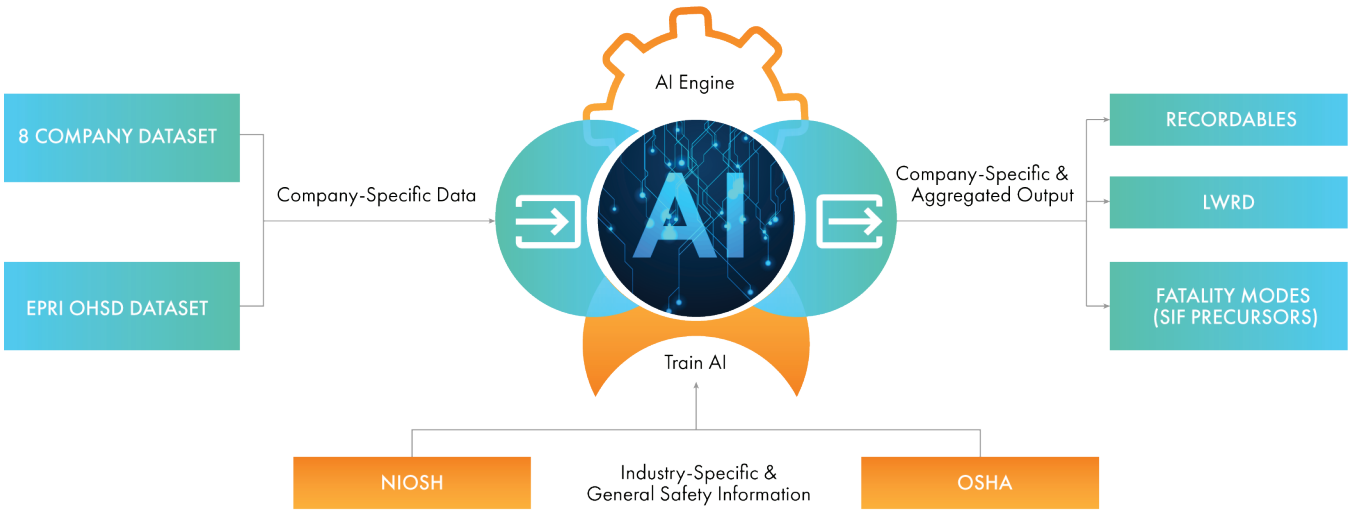
Identifying Serious Injury and Fatality Precursors
Using Artificial Intelligence and Machine Learning

A MODERN SAFETY STRATEGY

The severe, but infrequent occurrence of Serious Injuries and Fatalities (SIFs) can make it difficult for safety leaders to determine which of many possible incidents and conditions merit their attention and resources. In this unique study, Electric Power Research Institute (EPRI) used the latest Artificial Intelligence (AI) and machine learning tools, such as Natural Language Processing (NLP), to analyze a large database of electric power company safety records. With a goal to help improve safety performance by providing data to focus resources, research explored whether these new and advancing tools could determine precursors of potentially serious injuries or fatalities and help lay the foundation for a modern, effective, data-driven safety strategy.

Eight company datasets, augmented with EPRI's Occupational Health and Safety Database (OHSD), totaled more than 100,000 electric power safety records spanning 26 years. In addition, two government fatality datasets with deep descriptions of fatalities in the electric power sector were used to train the AI engine* which was then used in this project to identify the situations or processes (fatality modes) in the EPRI project datasets.



*The AI process to find potential SIFs is patent pending by Bowers Management Analytics, LLC.

KEY FINDINGS

Frequently occurring types of safety incidents, such as hand injuries or debris in the eye, tend to distract safety professionals from the less frequent, but more serious incident types that warrant greater attention.

Recordable injuries (as defined by the Occupational Safety and Health Administration) are dominated by safety incident types that are less likely to cause serious injuries or fatalities. *See Figure 2.*

Lost workday case injuries are dominated by soft tissue and musculoskeletal injuries such as knee, back, neck and shoulder injuries. Repetitive motion, especially keyboarding, can lead to some of the longest-lasting lost workday injuries. The average lost workday duration for a repetitive motion injury from keyboarding is dramatically higher than for other common lost workday injuries such as knee or shoulder injuries. *See Figures 3 and 4.*

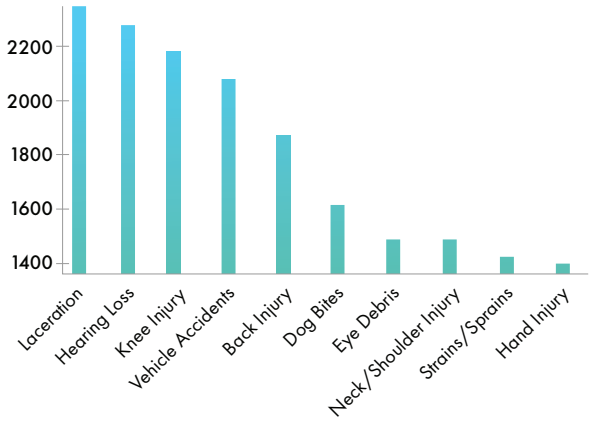


Figure 2 AI Incident Types that Dominate OSHA Recordable Injuries

The chart above displays AI incident types that cause the most Occupational Safety and Health Administration (OSHA) recordable injuries. These are the injuries that most safety professionals spend much of their time trying to reduce and prevent. However, they are not necessarily the AI incident types that drive lost workdays or fatality risk.

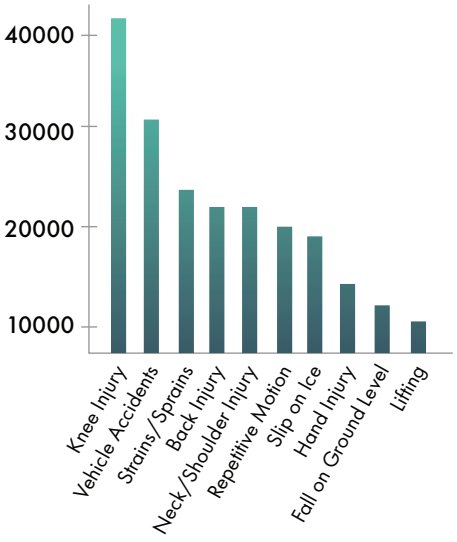


Figure 3 AI Incident Types that Cause the Most Cumulative Lost Workdays

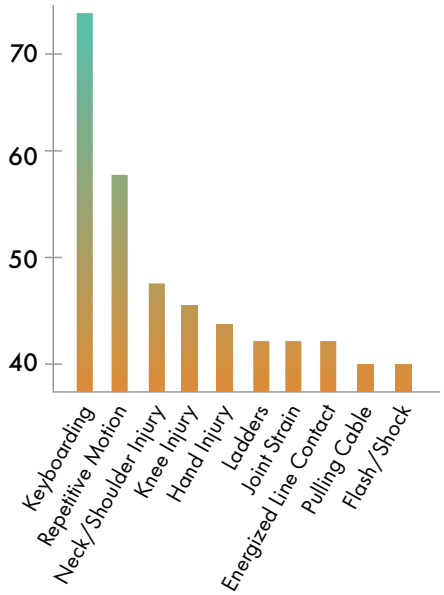


Figure 4 AI Incident Types and Average Lost or Restricted Workdays — Most Time Away from Work

KEY FINDINGS (continued)

Manually reviewing safety incident reports to identify precursor conditions or work settings for potentially serious injuries and fatalities is difficult. Manual reviews cannot analyze enough reports to reliably identify very infrequent events and conditions that are more likely to result in serious injuries and fatalities. Using AI, this study identified numerous SIF precursor conditions called fatality modes.

A preliminary ranking of high-level fatality modes in the electric power industry includes:

Tree Cutting and Trimming	Falls from a Height	Use of Ladders	Motor Vehicle Accidents	Tool Accidents	Forklift (Un)Loading

Potentially serious injuries and fatalities contrast with recordable injuries and lost workday injuries in terms of impact, frequency, visibility, data availability, and physical forces involved. *See Figure 5.*

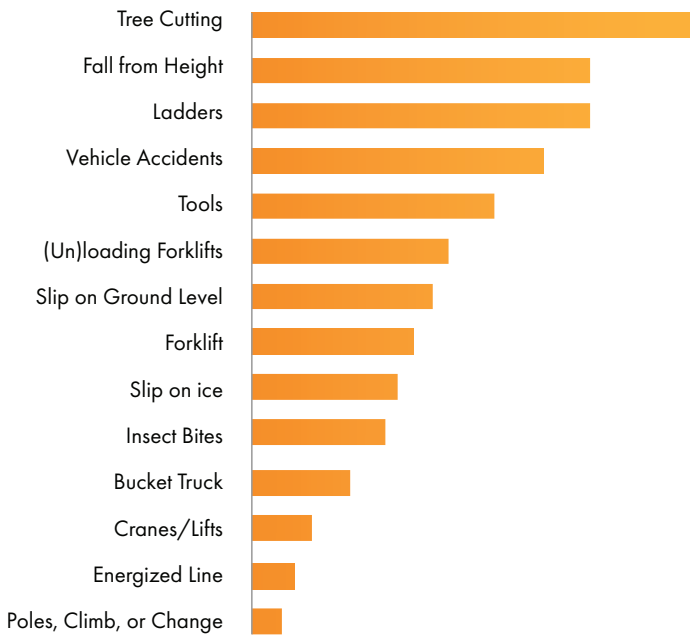


Figure 5 Relative Estimate of Fatality Modes (SIF Precursors) - Event Risk and Frequency

This chart represents all AI incident types which are identified as Fatality Modes (SIF Precursors), ranked by estimated relative frequency of occurrence. Fatality modes shown higher on the chart are more likely to happen with slightly higher frequency than those shown lower on the chart. The relative ranking of fatality modes on the chart is a function of three key parameters:

1. How frequently the activity occurs. For example, driving a motor vehicle occurs much more frequently than changing a utility pole.
2. How risky a given scenario is. That is, how often it leads to serious injuries or fatalities. Changing a utility pole is inherently dangerous because of the strong forces involved. It is a higher-risk but lower-frequency activity than motor vehicle use.
3. How frequently the fatalities occur in the government records. This is a gauge of how common this workplace fatality scenario is in comparison to other workplace fatalities across all industries.

HOW TO APPLY RESULTS AND NEXT STEPS

EPRI members can apply the results of this study to better understand high-risk safety incident types that drive lost workdays and potential fatalities in the electric power industry. Members can review detailed graphs in the full report to compare the top AI incident types and fatality modes to their own experience to determine if the programs have sufficient safeguards against these high-impact safety incidents. These results will also be used by EPRI in establishing future research projects.

EPRI's Occupational Health and Safety Program (P62) has aligned its research agenda to develop new tools and knowledge to support EPRI member companies in their quest to reduce SIFs. SIF reduction is a multifaceted endeavor, including development and application of technologies to reduce workers' exposures, address fatigue, enhance heat stress management strategies, reduce motor vehicle accidents, and more.

For more details on this study, please see EPRI report: *Identifying Serious Injury and Fatality Precursors Using Artificial Intelligence and Machine Learning*. EPRI, Palo Alto, CA: 2021. 3002021086.

More information about EPRI's Occupational Health and Safety Program (P62) research can be found on www.EPRI.com.

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