AISTech 2025 — Proceedings of the Iron & Steel Technology Conference
5–8 May 2025, Nashville, Tenn., USA
DOI: 10.33313/389/001

Artificial Intelligence-Assisted Accident Investigation: Improving Safety Reporting With LLMs

Qingyun Pu[1], Dhwanil Chauhan[1], John Moreland[1], Kyle Toth[1], Chenn Zhou[1], Erik Archer[2], Nathan Berry[2]

[1]Center for Innovation through Visualization and Simulation; Purdue University Northwest,
2200 169th Street, Hammond, IN 46323, USA
Phone: 1-219-989-2665
Email: czhou@pnw.edu

[2] Cleveland-Cliffs Burns Harbor
250 W. U.S. Highway 12, Burns Harbor, IN 46304

ABSTRACT

This paper describes the Artificial Intelligence Assisted Accident Investigation (AI-AAI) project, which is funded by the 2024 Don B. Daily Safety Grant. This project seeks to explore the usage of large language models (LLM) to help in the process of creating, filing and cross-referencing safety reports, and helping to make reporting more convenient and consistent. The project also aims to help with offering suggestions on root cause and possible mitigations based on previous investigations and reporting. This also seeks to help with the reporting of near misses and minor incidents, which can help identify leading factors leading to significant injuries and fatalities in the field.

1. INTRODUCTION

Incident reporting and investigation is a pretty big topic when it comes to safety and incident investigation. Despite advances in safety protocols and reporting systems, significant challenges remain in accident investigation, particularly in collecting accurate, timely, and comprehensive data [1,2]. Inadequate incident reporting, inconsistent record keeping, and a lack of lessons to be learned from historical records often hinder analysis of the true root causes of incidents and safety improvements.

There has been study done on how impactful good reporting can be to the overall safety and safety culture of the plant. Looking at a study conducted across two facilities in India that processed sinter and iron, the general consensus was that there were considerable contributions to incidents due to improper operating procedures, and unsafe acts made by employees due to complacency from process experience. [1] Through the data collected, it was also apparent that the management played a huge role in how much proper reporting occurred, that allowed these patterns to be captured in the data, and addressed at a plant-level.

A second example of two metal producers in Denmark showed that over 2 years, a new safety reporting system implementation happened to be very effective at increasing reporting and lowering accidents at one site, lack of any follow-up or intervention from management, similar to the India example. [2] Some takeaways from this particular study were that major issues were employee willingness to report due to frustrations with the reporting system itself, lack of support for the safety culture at the higher levels, and understanding the reporting of Near-Misses (NMs).

Incident investigation and reporting are critical components of workplace safety. These processes not only document the chain of events that led to an incident, but more importantly, identify root causes and recommend preventive measures to reduce the risk of future incidents [3,5].

One particular area that needs help is the reporting of NMs. These are one of the few places that people can report incidents that can help proactively address incidents. [5] Currently, safety performance is and has been largely driven by measuring and lowering lagging factors and trying to lower them, such as injuries/illnesses/fatalities. According to the well referenced Heinrich's Triangle, if we can catch and respond to leading indicators like near misses and unsafe acts, we can effectively act and reduce minor injuries and Significant Injuries and Fatalities (SIFs).

