

ARTIFICIAL INTELLIGENCE IN FIRE AND EXPLOSION INVESTIGATION – A CAUTIONARY TALE

INTRODUCTION

Artificial Intelligence is more than a mere buzzword; it is a pragmatic tool transforming the technology employed by fire and explosion investigators. Understanding what *Artificial Intelligence (AI)* is and how it evolves and potentially impacts our methodology, opinions, and conclusions is intriguing and essential to those investigating fires and explosions. AI, as it is often referred to, offers new possibilities and enhances our capabilities, instilling a sense of optimism for the future of our field. This article aims not to explain what *AI* is but to increase awareness that it is applied daily in our duties and responsibilities as fire and explosion investigators and advocate caution in its development and application. Its real-world applications reshape our investigative approach, present fresh opportunities, and amplify our capabilities. Let us remember the importance of a balanced approach and the responsibility for the ethical and effective use of AI in our field.

While Artificial Intelligence has undeniably emerged as a powerful tool for addressing complex problems, it's not without risks. In this article, we delve into its role in boosting investigation efficiency and its advantages to professionals in our field. This paper emphasizes the need for a measured and balanced approach that harnesses its potential power while underlining the importance of exercising caution in its development and application. This caution is not just a suggestion but a responsibility we all share to ensure this formidable tool's ethical and practical use. The gravity of this responsibility cannot be overstated, as the misuse of AI can have severe consequences in our field.

NFPA 921 - Guide for Fire and Explosive Investigations is widely referred to by fire and explosion investigators as a reference source. It is also a critical resource that can aid in integrating emerging technologies, including *AI*, and, together with NFPA 1033- Standard for Professional Qualifications for Fire Investigators, forms the basis of a *standard of care* in our profession. We must continuously update our knowledge regarding the content and changes within both these standards to maintain that standard of care. The lack of such knowledge may reduce the integrity and credibility of our work and render an investigator unqualified to testify in a legal proceeding. This underscores the importance of staying updated with these standards, as it directly impacts our professional standing and the quality of our work.

Neither NFPA 921 nor NFPA 1033 expressly acknowledges artificial intelligence but highlights the need for us to stay informed and adapt to our field's changing landscape. While NFPA 921 does not directly address Artificial Intelligence, the document remains a critical resource for investigators, and its principles can inform us of the integration of emerging technologies in the field.

A cautionary tale is told in folklore and ubiquitous in popular culture to warn listeners of dangers and spread awareness. At the very least, fire and explosion investigators must understand what AI is, how it currently permeates our discipline, and to what degree it will impact our profession in the future. This understanding will empower us to adapt and utilize AI effectively and positively in our investigations and avoid its negative impact. Many urban legends are framed as cautionary tales, from The Lover's Lane, haunted by a hook-handed murderer, to the story of a

man who shot a cactus for fun only to die when the plant toppled onto him.¹

Unlike most cautionary tales, not only does this paper explain how AI is currently embedded in the present fabric of our discipline and offers solutions for bettering its future application, but it also warns of its possible negative impact. A *cautionary tale* often relies on analogy, a comparison of two things for explanation or clarification, or metaphor, a figure of speech or idea used in place of another to suggest an analogy or similarity between them. For example, the ‘woods’ in Little Red Riding Hood is an analogy or metaphor for artificial intelligence.



Countless versions of “Little Red Riding Hood” exist, many of which reflect the concerns and moral issues of the period in which each version first appeared. The story originated in the Middle Ages in Europe as a cautionary tale to warn small children about the dangers of the woods.

Figure 1 – Little Red Riding Hood. An example of a Cautionary Tale

The National Fire Protection Association created a set of investigative guidelines in 1992 that was published as “*NFPA 921: Guide for Fire and Explosion Investigations*.” Even before then, in 1980, the National Bureau of Standards published the *Fire Investigation Handbook*, a reference standard designed to be used by the beginning or by the experienced fire investigator. Both public and private fire investigators currently use NFPA 921, which describes in detail the scientific method and how to apply it in fire and explosion investigations. The stated purpose of the guide has been and continues to be to “improve the probability of reaching sound decisions.”²

The reader of this article and NFPA 921 should realize that such an outcome is never guaranteed, only that the probability of its outcome is increased. We can only judge how accurate or correct something is by identifying and stating its probability. This is because the bedrock of science is not its certainty but uncertainty. NFPA 921, for example, requires an investigator to know the *level of certainty* needed to express an expert opinion and that only when the opinion is considered *probable* should it be described with *reasonable certainty*. Otherwise, anything is possible if the certainty level is only *suspected*.

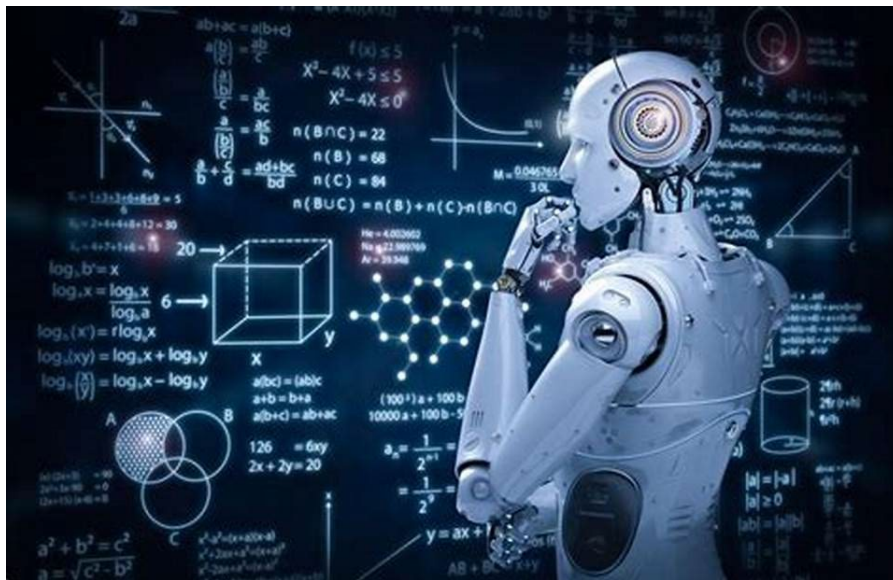
¹ Cautionary Tale – From Wikipedia, the free library

² 2024 - NFPA 921 – Guide for Fire and Explosion Investigations – Chapter 1.2 Purpose – Section 1.3

Over time, NFPA 921’s recommendations have grown to include guidelines for determining the origin and cause of fires, collecting and managing physical evidence, and chapters focusing on motor vehicle fires, wildfires, and appliances. The standard was recently changed in the 2024 edition to enhance its effectiveness and address evolving needs in fire and explosion investigations. Specifically, the 2024 edition of NFPA 921 provides additional guidance on bias and expressions of certainty on conclusions, the impact of suppression activities, fire effects on electrical systems, and updates concerning fire patterns, arc mapping, and fire classification. These updates aim to improve the accuracy, reliability, and consistency of investigations and include the following:

1. *Advancements in Science and Technology* - As our understanding of fire dynamics, materials, and forensic techniques evolves, the guide must incorporate the latest scientific and technological advancements, including *AI*.
2. *Feedback from Practitioners* – Input from fire investigators, legal professionals, and other stakeholders is crucial.
3. *Legal and insurance requirements* - The standard is a reference for legal proceedings and insurance claims. Its updates strive to align with changing legal requirements and industry practices.
4. *Improved Clarity and Consistency* - The 2024 edition clarifies concepts, provides additional guidance, and promotes investigation consistency, helping investigators reach accurate conclusions.

Whether termed a *guide* or adopted into law, NFPA 921 is widely regarded as the *standard of care* in fire and explosion investigation. Realistically, its provisions are considered authoritative and utilized by many courts when determining the sufficiency and admissibility of expert opinions. While both NFPA 921 and NFPA 1033 focus on traditional investigative methodologies, each indirectly recognizes the potential impact of AI (artificial intelligence) and ML (machine learning) on enhancing investigative practices.



Artificial intelligence (AI) refers to a computer or computer-controlled robot's ability to perform complex tasks historically only humans could do, such as reasoning, making decisions, or solving problems commonly associated with intelligent beings.

Figure 2 - AI systems can process enormous amounts of data, identify patterns, and make decisions based on collected information.

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is the theory and development of computer systems capable of performing tasks that historically required human intelligence, such as recognizing speech, making decisions, and identifying patterns—AI technologies include machine learning, deep learning, and natural language processing (NLP).

"Though the humanoid robots often associated with AI as seen in the contemporary I, ROBOT, film does not exist yet; you've likely interacted with machine learning-powered services or devices many times before." Today, "AI" describes a wide range of technologies that power many of the services and goods we use daily, from apps that recommend TV shows to chatbots that provide customer support in real-time.

At the most superficial level, machine learning uses algorithms trained on data sets to create machine learning models that allow computer systems to perform tasks like making song recommendations, identifying the fastest way to travel to a destination, or translating text from one language to another. Some common examples of AI in use today across our culture include:

- **ChatGPT:** Uses large language models (LLMs) to generate text responding to questions or comments.
- **Google Translate:** Uses deep learning algorithms to translate text from one language to another."
- **Netflix:** Uses machine learning algorithms to create personalized recommendation engines for users based on their previous viewing history.
- **Tesla:** Uses computer vision to power self-driving features on their cars.

ARTIFICIAL INTELLIGENCE IN THE FIRE SERVICE

The integration of AI into the fire service brings about significant efficiency improvements. AI streamlines time-consuming tasks like data collection, analysis, and report generation through automation. By automating these processes, users can focus on higher-value tasks. In the fire service, artificial intelligence can help respond to and assess a fire scene to make decisions about extinguishing a fire and limiting its spread and damage.

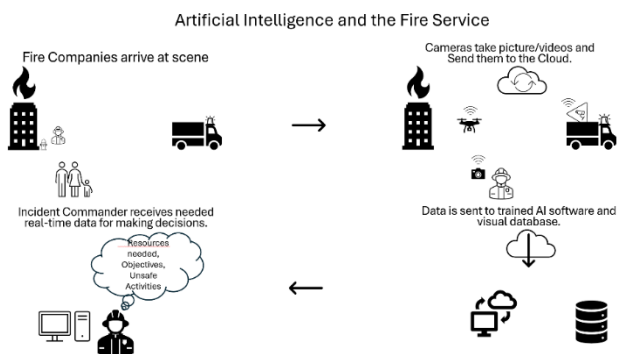


Figure 3 – Artificial Intelligence in the Fire Service



Figure 4 – Collected data can be used in real-time to suppress or extinguish a fire.

AI revolutionizes firefighting by providing critical insights, improving safety, and enhancing response capabilities. It is currently used in flashover prediction, data interpretation, on-scene data collection, and real-time traffic analytics. Artificial intelligence data can also be used to assess building and fire conditions.

ARTIFICIAL INTELLIGENCE IN FIRE AND EXPLOSION INVESTIGATION ³

Fire Pattern Analysis: AI algorithms are instrumental in deciphering complex fire patterns. AI systems can identify distinctive patterns that may elude the human eye by processing images and data from fire scenes. This aids investigators in reconstructing the sequence of events leading to a fire.

Predictive Modeling: Machine Learning algorithms can be trained on historical fire data to develop predictive models. These models help anticipate potential fire hazards, assess the risk of specific scenarios, and enable proactive design, prevention, and investigation measures.

Evidence Analysis: AI technologies facilitate rapid and precise analysis of evidence collected from fire scenes. Whether identifying accelerants, analyzing burn patterns, or categorizing fire-related artifacts, AI enhances the speed and accuracy of evidence interpretation.

Real-time Monitoring: Integrating AI with sensors and monitoring devices allows for real-time assessment of fire-prone areas. AI algorithms can analyze environmental conditions, detect anomalies, and alert authorities to potential fire risks, enabling swift intervention.

While AI has transformed almost all professions by developing advanced tools and techniques, it may also be used in fire and explosion investigations to research and gather data, generate hypotheses, make decisions, and develop strategies. AI's ability to manage repetitive and mundane

³ ["Unveiling the Future: Harnessing AI and Machine Learning in Fire Investigation" - Ohio Arson School \(ohioarsonschoolinc.org\)](https://ohioarsonschoolinc.org)

tasks allows investigators to dedicate more time to critical thinking and problem-solving, resulting in faster and more accurate investigation outcomes.

Fire and explosion investigation is a complex process involving knowledge spanning several disciplines. Machine learning and natural language processing empower investigators to analyze vast quantities of digital evidence rapidly and accurately. By identifying patterns, anomalies, and connections, AI algorithms uncover hidden insights that might otherwise remain concealed. These AI-powered investigation techniques optimize time and boost efficiency and effectiveness.

“AI-powered analytics already drill down into databases and documents and auto-produce easy-to-understand written reports that unearth insights about trends or patterns that otherwise may never have seen the light of day.” [4] AI analytics can generate reports that provide insights about trends or patterns in fire and explosion investigations. AI-powered search engines can process enormous amounts of data and provide relevant information related to fire investigation techniques, legal requirements, and other relevant topics.

For example, an investigator or expert finds a restaurant extinguishing system did not function correctly during a fire, either failing to put out a fire or allowing it to spread and observing crystallization in the liquid extinguishing agent during a laboratory examination after opening the extinguishing canister. A search using COPILOT ⁴ (an application based on artificial intelligence) returns the following possible reasons to explore (e.g., changes in temperature, pressure, or chemical composition.) The findings would point the investigator to evaluate or explore whether any conclusions were consistent with the facts and data before developing a final hypothesis concerning the fire's origin, cause, and responsibility.

COPILOT results for the question “What are the reasons for crystallization in ANSUL systems?” - ANSUL systems are industry-standard fire suppression systems used in environments like restaurants. They work by discharging a mixture of wet chemicals when fires are detected, smothering the flames and preventing them from reacting with oxygen. (“Maintaining Your ANSUL System in A Restaurant: What You Need to Know”)

However, the search results do not explicitly mention the reasons for crystallization in ANSUL systems. Crystallization could occur due to a range of factors, such as changes in temperature, pressure, or chemical composition, but with specific information, it is easier to determine the exact cause.

Proper maintenance of these systems is essential to ensuring their effectiveness. This includes regular professional inspections, good restaurant practices to prevent grease build-up, and staying current on documentation. If you are experiencing issues with crystallization in your ANSUL system, it would be best to consult a professional or the manufacturer for guidance.

⁴ COPILOT - Microsoft developed COPILOT, part of the Windows operating system. It is designed to assist users in providing information, answering questions, and engaging in conversation. It uses advanced language models and other technologies to understand and communicate fluently. It can help with various tasks, from generating content to providing information on complex topics.

Artificial Intelligence (AI) is currently incorporated into technology used by fire and explosion investigators in the following ways:

AI is built into smoke and heat detector devices and components of fire protection systems. It has transformed investigations by developing advanced tools and techniques. AI plays a crucial role in analyzing data from smoke and heat detectors, cameras, and instrumentation and processing data from equipment used to detect and analyze debris and artifacts. AI is used to analyze data to design, place, and collect data from these devices to detect smoke and flames, identify patterns, and make decisions about the presence of fire or smoke.

AI records, captures, and measures fire and explosion events with cameras and video. It can analyze the data collected by these devices to identify essential information related to the origin and cause of the incident. Equipment used to detect and analyze debris and artifacts. AI is incorporated into equipment that processes data from hydrocarbon detectors, CT scans, GCMS, and MS (Gas Chromatography-Mass Spectrometry) devices. This helps investigators identify specific substances or chemicals at the scene and determine their relevance to the fire or explosion.

Digital evidence analysis is crucial in forensic investigations, encompassing various data sources like emails, social media, financial transactions, and surveillance footage. AI algorithms are instrumental in analyzing and interpreting this vast data, revealing relevant patterns and information. Machine learning algorithms excel at identifying similarities, outliers, and suspicious activities, enabling investigators to connect the dots and build strong cases. By leveraging AI-powered forensic tools, investigators can efficiently manage digital evidence's growing complexity and volume.

The admissibility of an expert opinion requires that the expert be qualified. The National Fire Protection Association provides standards for the minimum professional qualifications for a fire investigator in NFPA 1033—Standard for Professional Qualifications for Fire Investigators. The standard requires an expert to maintain updated basic knowledge in several areas, including, but not limited to, fire chemistry and thermodynamics. Additionally, NFPA 1033 requires updated knowledge regarding fire investigation methodology and evidence documentation.

AI-powered analytics can generate reports that provide valuable insights about trends or patterns in fire and explosion investigations. This enhances our understanding of these incidents and streamlines the reporting process, making it more efficient. In report writing, limited aspects of AI are already used to research definitions and issues related to the origin, cause, and responsibility for fires and explosions. It can also ask questions from documents and create summaries of depositions used for legal proceedings, ensuring that our legal processes are thorough and efficient. While AI can undoubtedly improve the efficiency and speed of report writing, it has limitations. It does not meet existing legal requirements regarding its content and identifying sources of information.

Ultimately, fire investigators author, publish, and review Origin ⁵ and Cause ⁶ Reports for their clients and the legal system, some of which opine indirectly or directly on responsibility ⁷ upon which judgments result in the legal process. As a result, the fire investigator's report often becomes the most critical documentary evidence in the legal process and the most *visible portion of an iceberg*. Like an iceberg, less attention is paid to the actual investigation (the portion that lies under the water) and the author than to the report itself (e.g., the visible iceberg that lies above the water.) Regardless of their purpose, every report should be considered an expert report, and it is vital that the testimony that evolves from a report is the product of reliable properties and methods and that the expert reliably applies verifiable principles and techniques to the facts of the case.

Artificial Intelligence has already entered the current report-writing process on many levels and will continue to evolve. You may have already encountered examples of it without knowing. Its presence in a report is challenging to detect, and the line that identifies its inclusion is becoming more blurred each day. Fire and explosion investigations and documentation are lengthy and complex, and the specific processes resulting from a report are not necessarily efficient or cost-effective. Authoring reports based on the analysis of a documented investigation involves time and money in the real world. Accordingly, much effort has been invested in developing ways and means to investigate a scene and generate reporting more efficiently.

Templates are the most popular and common method by which organizations approach the generation of reports. This method typically involves an organization-wide acceptance of a specific format with internal references that comply with external protocols and standards (e.g., NFPA 921, NFPA 1033, ASTM standards). The approach is implemented through internal technical and administrative reviews. It is a quality control approach to ensure the content and format of reports through review before the report is published or released.

The template technique may be replaced or supplemented with an 'active document' approach that automates the process by combining data extracted automatically, instantaneously, and remotely from the scene with the accepted internal format to produce a finished report. Organizations may also choose to reach out to other parties who specialize in developing reports based on these approaches and attempt to balance internal (e.g., organizational) and external (e.g., clients or the legal system) needs and demands.

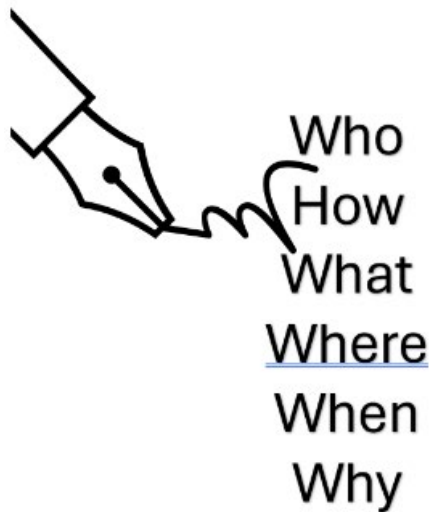
Organizations may adopt the generation of reports through external parties and incorporate them with their branding. Many of these third parties advertise that the finished report is generated either from live data recorded by the investigator from the scene or later from their notes and will meet the requirements of NFPA 921 and NFPA 1033. While AI can improve the efficiency and speed of report writing, it falls short of meeting existing legal requirements regarding its content and identifying sources of information.

⁵ NFPA 921- Section 3.3.153 – Point of Origin – The physical location with the area or origin where a heat source and an oxidizing agent first interact, resulting in a fire or explosion.

⁶ NFPA 921 – Section 3.3.74 - Fire Cause. - The circumstances, conditions, or agencies that bring together a fuel, ignition source, and oxidizer (such as air or oxygen) resulting in a fire or a combustion explosion.

⁷ NFPA 921 – Section 3.3.167 Responsibility – The accountability of a person or other entity for the event or sequence of events that caused the fire or explosion, spread of the fire, loss of life, or property damage.

At best, using a template guarantees uniformity throughout the organization and saves money and



time. However, it does not guarantee that the investigator's opinions and conclusions regarding the facts and evidence (hypothesis) are correct.

Figure 5 – Origin and Cause templates based on artificial intelligence.

To what degree artificial intelligence affects the substance of reports, not just their appearance or form is subject to question and discussion. Grammarly, for example, incorporates AI into its algorithms and claims to scrutinize an investigator's writing to improve clarity and word choice. Grammarly, however, goes beyond checking spelling and grammar; it also affects clarity, engagement, and delivery. Any attorney will tell you *how* you say something, orally or in writing, affects its meaning. In other words, the selection of words and use of language affects not only the appearance (i.e., form) of the expert's report but also its logic (i.e., substance.)

While AI solves many of the difficult choices to be made in establishing where a particular methodology (e.g., NFPA-921 Guide for Fire and Explosion Investigations) or requirement (e.g., NFPA 1033 Standard for Fire Investigator Qualifications) has been consulted and adhered to, it falls short of meeting existing legal requirements in terms of content. AI can improve the efficiency and accuracy of investigations, but it does not replace the need for human expertise and input. AI can assist in researching definitions and issues related to fire and explosions, asking questions from documents, and creating summaries of depositions. It can also help automate the generation of reports by combining data extracted from the scene with the accepted internal format of the report. What is certain is that it and other tools need human input for analysis and narrative.

The guidelines for expert witnesses in federal court are primarily outlined in Rule 26 of the Federal Rules of Civil Procedure.⁸, and can be downloaded from the United States Courts website at

⁸ www.uscourts.gov

www.uscourts.gov. While some states accept and implement the federal standard, every report should be considered an expert report, regardless of whether it is in the federal system. The reader of this article would also do well to review the Federal Plain Language Guidelines promulgated as law in 2010. Although these guidelines were developed to help federal agencies write documents clearly and understandably so that users can easily find, understand, and use the information they need, they can also be a valuable resource for expert witnesses who investigate and write reports concerning the origin, cause, and responsibility for fire and explosions and help to understand their audience, organize the report, apply sound writing principles, and test the document's effectiveness in reaching its intended audience.

AI may establish whether a methodology (NFPA-921) or requirement (NFPA 1033) was consulted and adhered to, is cost-effective, overcomes writer's block, creates content faster than people, and is economical. However, it also falls short of meeting existing legal requirements regarding its content. Unfortunately, readers believe what they read or see, regardless of whether it is accurate, and truth, at least in the legal system, is determined by the vote of a jury based on their assessment of facts and evidence presented to them. The rules of the legal system require an expert who offers an opinion to disclose the materials consulted and where the material that the opinions rely on was obtained. Currently, AI may not disclose this information and, in some cases, may misrepresent the facts or partially explain them, disguise incompetence, or allow bias to enter the system.

Artificial intelligence can create realistic images from textual input or information (e.g., in the photo at the left) or enhance existing images. Examples of resources that can help create images are Canva's AI Image Generator, Hotspot.ai, ImagineArt AI Generator, and OpenArts's Image Generator.



An AI-generated or enhanced image can be used as evidence in reports to convince others (e.g., other experts, attorneys, or a judge and jury) to interpret evidence differently. Fortunately, the GPS and meta-data recorded when fire and explosion investigators create or collect images cannot be modified or erased from their cameras' original raw data, assuming it is still available for the reasonable examination of others.

For this reason, some are unwilling to provide the original data and instead offer digital copies. One example is PDFs that have either removed or erased essential information concerning where and when the image was collected and whether it has since been modified.

Figure 6 – Image created using artificial intelligence.

In the future, expect Artificial Intelligence in many reports regarding fires or explosions you receive, certainly in form or appearance and progressively in substance (e.g., opinions and

conclusions). Likely, artificial intelligence may eventually replace technical and administrative review of reports if for no other reason than it already has, or will become, more efficient and cost-effective.

THE FUTURE OF ARTIFICIAL INTELLIGENCE – CHALLENGES AND ETHICAL CONSIDERATIONS

Artificial intelligence currently includes a wide range of applications with the potential to transform how we work and live. It is a complicated picture of potential benefits and dangers. While integrating AI in fire and explosion investigation in the future holds immense promise, it also presents challenges, including ethical considerations. Ensuring the reliability and interpretability of AI-generated results is crucial. Fire investigators must understand the algorithms they deploy and be cautious of potential biases in data that might impact the accuracy of their predictions (e.g., opinions and conclusions.)

Ethical considerations include the responsible use of AI in investigations, preserving privacy rights, and maintaining transparency in decision-making processes. Striking a balance between harnessing the benefits of technology and upholding ethical standards is essential for the responsible adoption of AI in fire investigations.

As we navigate the evolving landscape of fire investigation, integrating Artificial Intelligence toward enhanced efficiency, accuracy, and a safer future. Merging innovative technology and established industry standards propels us into a new era of investigative possibilities and accuracy. With the power to unravel complex fire patterns, predict potential hazards, and assist in cause determination, AI is not merely a tool but an ally in the pursuit of truth. As we embrace these advancements, we must move forward carefully, acknowledging the challenges and ethical considerations.

In fire investigation, where precision and reliability are paramount, the synergistic dance between human expertise, reasoning, and technological innovation promises a future where mysteries are unraveled, risks are mitigated, and justice is served. As we move into this future, guided by industry standards and a commitment to responsible implementation, we look to a future where the fusion of human intellect and artificial intelligence offers us the promise of gains in fire investigation.

To what degree Artificial Intelligence will evolve and permeate the entire fire and explosion investigative process and eventually become reflected in NFPA Standards 921 and 1033 depends on time, technology, and the legal system. Regardless, our actions, opinions, and findings must remain truthful, documentable, and verifiable to be credible and ultimately admissible in legal proceedings.

While many of these transformations offer exciting benefits, like self-driving cars, virtual assistants, or wearable devices in the healthcare industry, they pose many challenges. The landscape of fire and explosion investigation is transforming as it embraces further advancements in Artificial Intelligence (AI).

The author of this paper wishes to remind the reader that despite people often believing what they read or see, the truth usually lies between two extremes, and reality is likely more complex (or simpler) than realized or imagined. Ultimately, we would be better served not to shift blame but to realize that the responsibility is ours to shoulder, “that doing wrong that good may come of it is never right and that we must act right whatever the consequence.”⁹

Artificial intelligence has already found its way into fire and explosion investigation and the current report-writing process on some levels and will continue to do so. Until methods become available to detect its presence, impact, and influence on our opinions and conclusions, investigators must continue to know and apply accepted principles required by guidelines like NFPA 921 and standards like NFPA 1033, recognized and accepted by our discipline and the legal system.

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1. Cautionary Tale – From Wikipedia, the free library.
 2. 2024 - NFPA 921 – Guide for Fire and Explosion Investigations – Chapter 1.2 Purpose – Section 1.33.
 3. "Unveiling the Future: Harnessing AI and Machine Learning in Fire Investigation" - Ohio Arson School (ohioarsonschoolinc.org)
 4. Ellington, J.M. (2024) Blog on Artificial Intelligence and Fire Investigation. – <http://firelogix.net/my-blogs/f/artificial-intelligence>
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 6. "Unveiling the Future: Harnessing AI and Machine Learning in Fire Investigation" - Ohio Arson School (ohioarsonschoolinc.org)
 7. Plain Language Guidelines <http://www.plainlanguage.gov/media/FederalPLguidelines.pdf>
 8. H.W. Crocker III, Robert E. Lee on Leadership – Executive Lessons in Character, Courage, and Vision, 1999, FORUM - A Prima Publishing Company

⁹ H.W. Crocker III, Robert E. Lee on Leadership – Executive Lessons in Character, Courage, and Vision, 1999, FORUM - A Prima Publishing Company