An era of turmoil and transition

The Great War, automation, increased productivity, exhaustion, and accidents; defining the role of the laborer in industrial accidents and their prevention

LEGEND
- Safety scientist/activist
- Safety problem
- Safety legislation
- Safety concept
- Safety slogan

During this period in the United States

The Safety First movement, including Eastman's "Pittsburgh Suevey," highlighted the need for improved safety practices. Media coverage of struggling families, accident costs on insurers, and hidden expenses further fuelled the call for safety enhancements. Managers recognized the link between safety, efficiency, production continuity, and quality.

The American Engineering Council's report on "Safety and Production" (1928) confirmed the connection between occupational safety and industrial efficiency. Publications often blamed workers (75-90% of the time) for accidents. However, others pointed to increased production, monotonous work, and long hours affecting performance.

Scientific management whose indirect impact on conventional safety management persists to this day, was put forward by Frederick Taylor which emphasized organizations as mechanical entities and employees as rational thinkers and operators. His active management approach relied on scientific methods for monitoring, hiring, regulating, and promoting cooperation. Behavioral management came about as the result of Mayo and Roethlisberger's Hawthorne experiments.

Frederick W. Taylor (1856-1915), the father of scientific management, revolutionized industry with his time-motion studies and efficiency-focused approach to work optimization.

They challenged the previous mechanical and logical views, revealing the significance of supervisor involvement, psychological factors, and group dynamics. These findings sparked the human relations movement, reshaping workplace dynamics beyond monetary incentives.

Elton Mayo (left) and Fritz J. Roethlisberger (right), ca 1940. Photo courtesy of the Baker Library Historical Collections, Harvard Business School.

Safety technique initiates the occupational safety concept. Engineers and technicians focused on safety measures like enclosing platforms and safeguarding machinery parts. They recognized hazards related to human-machine interaction and working at heights. Professional publications showcased safety practices through visuals. Cowee published his influential safety reference book emphasizing worker behavior as the main cause of accidents, promoted safety education and advocated for safety committees while covering hazardous sectors, mitigation strategies, and safety management.

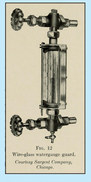
DeBlois, in his revolutionary safety book, was the first to introduce the concepts of "hazard", "probability of an accident". He viewed accidents as sequence of events starting with a hazard. He challenged the safety first movement and viewed safety as management's responsibility and not workers' responsibility.

Safety technique in practice, the illustration shows an instance of improved safety by installing guards on a stairway opening; the original caption reads: "Properly guarded stairway opening. Courtesy Goulds Manufacturing Company." Taken from Cowee's Practical Safety Methods and Devices, Manufacturing and Engineering. Credit: Library of Congress (HD7273 .C6)

Example of personal protective equipment from the period; the original caption reads: "Hood with respirator attachment, used for sandblasting. Courtesy S. F. Heyward Company, New York." Taken from Cowee's Practical Safety Methods and Devices, Manufacturing and Engineering. Credit: Library of Congress (HD7273 .C6)

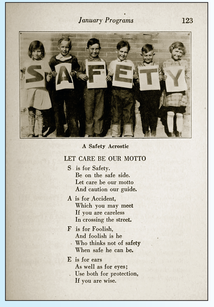
Safety technique in practice, the photo illustrates the use of a safety cone belt shifter to eliminate the use of hands for shifting the belt step in machines that use a cone step pulley, and associated damages: "Safety cone belt shifter. Courtesy R. K. Le Blond Machine Tool Co." Taken from Cowee's Practical Safety Methods and Devices, Manufacturing and Engineering. Credit: Library of Congress (HD7273 .C6)

Example of personal protective equipment from the period; the original caption reads: ""Congress" shoes and canvas leggings for foundrymen. Courtesy National Founders' Association." Taken from Cowee's Practical Safety Methods and Devices, Manufacturing and Engineering. Credit: Library of Congress (HD7273 .C6)



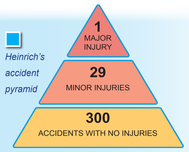
Safety technique in practice, an illustration depicting an improved design for boiler gauge glasses prone to shattering and causing eye damage due to wear; the original caption reads: "Wire-glass water gauge guard. Courtesy Sargent Company, Chicago." Taken from Cowee's Practical Safety Methods and Devices, Manufacturing and Engineering. Credit: Library of Congress (HD7273 .C6)

A page taken from Cowee's Practical Safety Methods and Devices, Manufacturing, and Engineering, depicting eye protective gear and the possible outcome of not being equipped with one. Credit: Library of Congress (HD7273 .C6)



Safety literature also extended to cover subjects related to household injuries. A page from Hyde and Slown's book, safety programs and activities for elementary and junior-high schools, includes an acrostic about SAFETY. Credit: Library of Congress (HV675.H8)

***Herbert William Heinrich**, a mechanical and safety engineer at Travelers Insurance, emphasized the significance of safety management integrated as safety services within organizations. He advocated for safety commissions led by employees.*
Indirect costs of accidents were first quantified by Heinrich, revealing them to be four times the worker's compensation. He also introduced the concept of the "accident mechanism," which relates to the severity of events.



Heinrich's accident pyramid

Heinrich claimed that for every 300 accidents without injury, there were 29 accidents with minor injuries and 1 with a major injury. This concept gave rise to the accident "iceberg" or "pyramid," even though he did not disclose the data sources.

The Three-Es Slogan was an impactful National Safety Council slogan and a key advancement during this period resulting from categorizing causes. The idea of inevitable accidents recedes, highlighting the significance of robust safety protocols and comprehensive employee education, as emphasized in numerous publications. The slogan encapsulated this shift in the National Safety Council.

The American Museum of Safety, founded in 1908, became a hub of inspiration and knowledge. Alongside awarding safety performance medals, publishing the esteemed journal "Safety", and hosting the National Safety Congress, the museum captivated passers-by with monthly displays of dioramas and devices in its windows starting from 1915.

Crowds gathered to view the American Museum of Safety exhibition windows, Twenty-fourth Street, New York. Photo by Anonymous, Promoting Safety Employing Window Displays, Safety 3, 6 (1915), 145.

The National Safety Council, established in 1913, became a pivotal catalyst for the thriving Safety First movement. Functioning akin to esteemed institutions like the British Royal Society for the Prevention of Accidents and the Dutch Safety Museum, it emerged as a central hub for safety initiatives and a primary source of safety-related publications. Companies eagerly embraced the Safety First Movement, employing various strategies to promote employee safety. They endeavoured to heighten awareness and inspire a strong commitment to safety by utilizing impactful mediums such as safety posters, bulletins, notice boards, and scoreboards.

American Museum of Safety's Illinois Steel Company Exhibition, the early 1910s. Credit: Southeast Chicago Archive and Storytelling Project, https://creativecommons.org/licenses/by-nc-sa/4.0/.

Example of a safety bulletin from the period; the original caption reads: "Safety bulletin board; Courtesy Middletown Car Company." Taken from Cowee's Practical Safety Methods and Devices, Manufacturing and Engineering. Credit: Library of Congress (HD7273 .C6)

Example of a safety suggestion box from the period; the original caption reads: "Safety suggestion box near factory entrance. Courtesy Commonwealth Steel Company." Taken from Cowee's Practical Safety Methods and Devices, Manufacturing and Engineering. Credit: Library of Congress (HD7273.C6)

During this period in the United Kingdom

In contrast to the US, the government initiated the UK's focus on occupational safety rather than market parties. With a long tradition of social legislation, the UK already had safety regulations in force for textile industries. The British approach to occupational safety had a scientific focus, distinct from the US.

In 1911, a committee's survey highlighted a rise in fatal industrial accidents attributed to inadequate machine safeguards, fatigued workers, and the employment of young workers. During World War I, the British government formed the Health of Munitions Workers Committee to assess productivity and safety in munition factories. This committee included representatives from various sectors.

The report revealed an increase in fatal industrial accidents due to inadequate machine safeguards, exhausted workers, and the employment of young individuals in hazardous tasks. After the war, the committee became the Industrial Fatigue Board and later the Industrial Health Research Board in 1929. These boards studied the impact of work organization on productivity and accident rates, examining factors such as working hours, lighting, temperature, ventilation, and cyclical work.

Women at work in a munitions production plant during the First World War, Chilwell, Nottinghamshire, England, UK, c 1917. Part of the Imperial War Museum Photograph Archive Collection.

Major Greenwood (1880-1949) English epidemiologist and statistician

The British scientific approach involved physicians, sociologists, and psychologists, contrasting with the American managerial approach. Greenwood and Woods authored the first report on occupational accidents, studying the occurrence of multiple accidents amongst women in munition factories and labeled the victims "susceptible workers". Although they used the term "susceptible workers" instead of accident-prone, their research became a standard publication. The rise of accident-prone workers and accident proneness was influenced by Darwin's ideas. In the 1920s, hygienists and psychoanalysts compared accidents to cancer and tuberculosis. Works by Greenwood, Collis, Hope, Hanna, and Stallybrass discussed accidents, compensation, prevention, and safety techniques. Collis and Greenwood attributed most accidents to a lack of worker control. Psychologists and psychoanalysts investigated individual factors contributing to accidents during the interwar period. Impulsive behavior and sensorimotor variables were identified as causes. Tests were created to identify accident-prone workers. The concept of "accident proneness" was introduced by Karl Marbe in Germany and Eric Farmer. However, the correlation between test results and accidents was low.
Osborne et al. (1922) investigated cutting accidents among ammunition workers during World War I, focusing on the influence of temperature using the environmental hypothesis. Accidents were least frequent at temperatures around 21°C and 23°C. Production output and accidents showed a correlation.

During this period in the Netherlands

The Safety Museum became a leading institution in safety, established by the industry. It experienced significant growth, expanding its activities. The 'Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek' (TNO) was established in 1932, driven by industrial interest in safety and the need for highly educated staff. TNO aimed to ensure the effective application of scientific research findings, particularly for businesses.

Dutch safety posters from the era. Many of the posters invite people to visit Amsterdam's safety museum at the time.

"Distraction causes accidents"
"Alcohol use increases the chance of accidents"
"That's happening because emergency exit is obstructed"
Dutch safety poster illustrating hazardous sockets which leave the bulb's base exposed in contrast to safer designs
"Treat every wound with any significance properly"

During the 1920s, the Safety Museum organized national safety conferences and developed impactful safety posters. Radio programs titled "Doe het veilig" (Do It Safely) provided practical information on tool hazards, ladder safety, and protective equipment. Safety posters were vital in promoting public health, covering industrial accidents and diseases like tuberculosis. Renowned artists created these posters, utilizing metaphors to depict the consequences of negligence. While occupational safety gained attention through legislation and government policies, road safety and safety at home remained concerns handled by private initiatives and local authorities.

1910-1930

Based on the book *From Safety to Safety Science* (Swuste et. al., 2022)