

SAFETY BULLETIN

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Risk Analysis

by Peter J. Poczynok¹ and Ralph L. Barnett²

Safety is characterized by only two concepts: hazard and risk. The magnitude of hazard, severity, describes how badly people are hurt. Its measure is ultimately subjective. On the other hand, risk, or frequency, is measured objectively by counting how often people are hurt. It is defined as the probability of encountering a hazard and receiving an injury.

The most important system for measuring risk is the accident frequency rate (AFR) which is defined as the number of disabling injuries per million man hours of employee exposure (USAS Z16.1 - 1967). The National Safety Council monitored the AFR for dozens of industries between 1926 and 1976. Thereafter, the NSC adopted an almost identical record keeping concept called the incidence rate, which is the number of recordable cases per 200,000 hours of employee exposure (ANSI Z 16.4 - 1977).

Taking the AFR as five times the incidence rate, the presentation of the AFR can be continued from 1976 to 1993, as shown in Figure 1 for the "all industries" category. We observe that the lowest recorded AFR was 5.99 which occurred in 1961. This value may be used by safety professionals as a benchmark for judging their efforts. When a design has an AFR much greater than 6, the time has come to revisit the drawing board; an AFR lower than 6 means that the safety strategy is moving in the right direction. Figure 2 presents the AFR for the "machinery" category from 1937 to 1993.

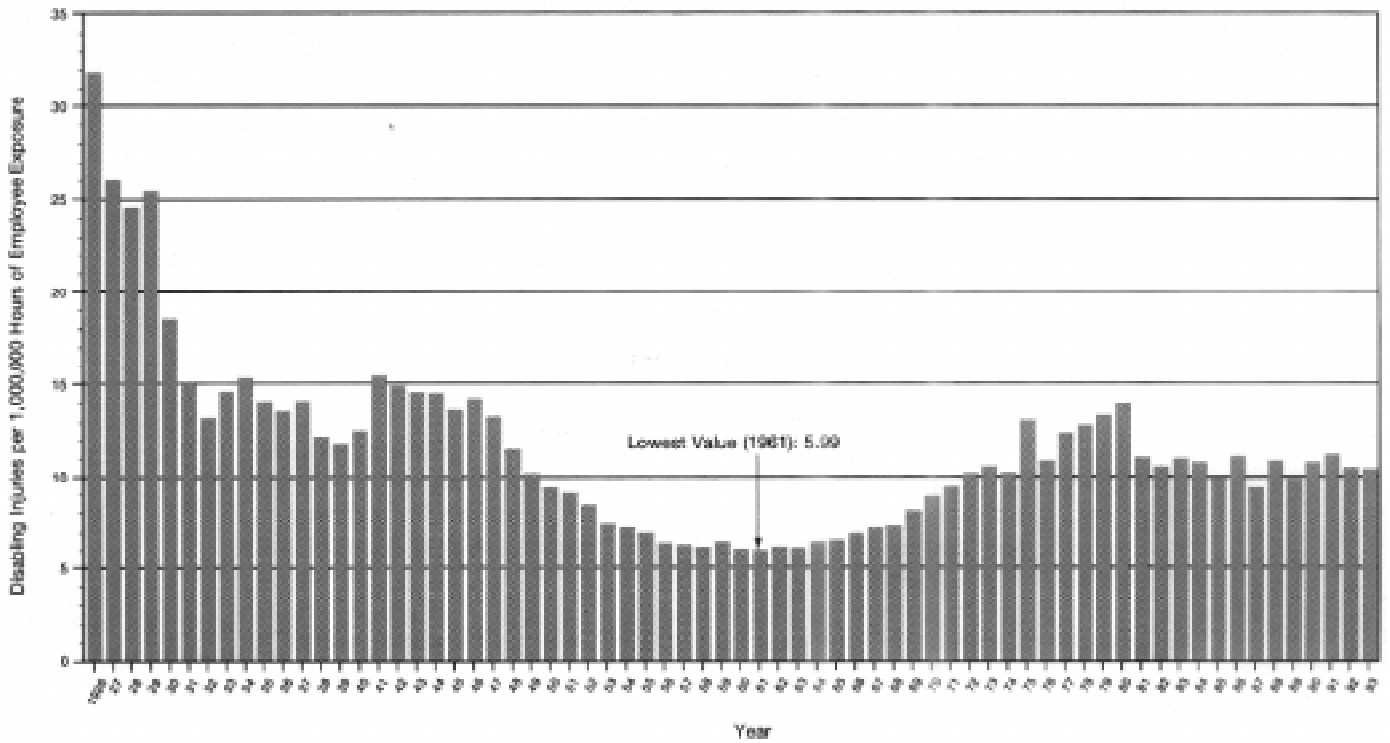
A few characteristics of the AFR are worth noting:

- The National Safety Council gets most of its data from its company membership.
- The incidence rate has a slightly more restrictive definition of disabling injury than the AFR; it leads to a somewhat smaller AFR.
- Errors in counting disabling injuries and errors in counting employee exposure are greater than the error in the ratio between them, i.e., the AFR is more stable than its numerator or denominator.
- The current AFR, on the average, implies that every worker will suffer one disabling injury during his or her working career.
- A dramatic increase in the AFR in the next few years would make the bar graph in Figure 1 symmetrical. This may come about because of deregulation in safety rulemaking, deemphasis of safety training and enforcement, cutbacks in safety research and tort reform that limits the corrective power of the product liability system.

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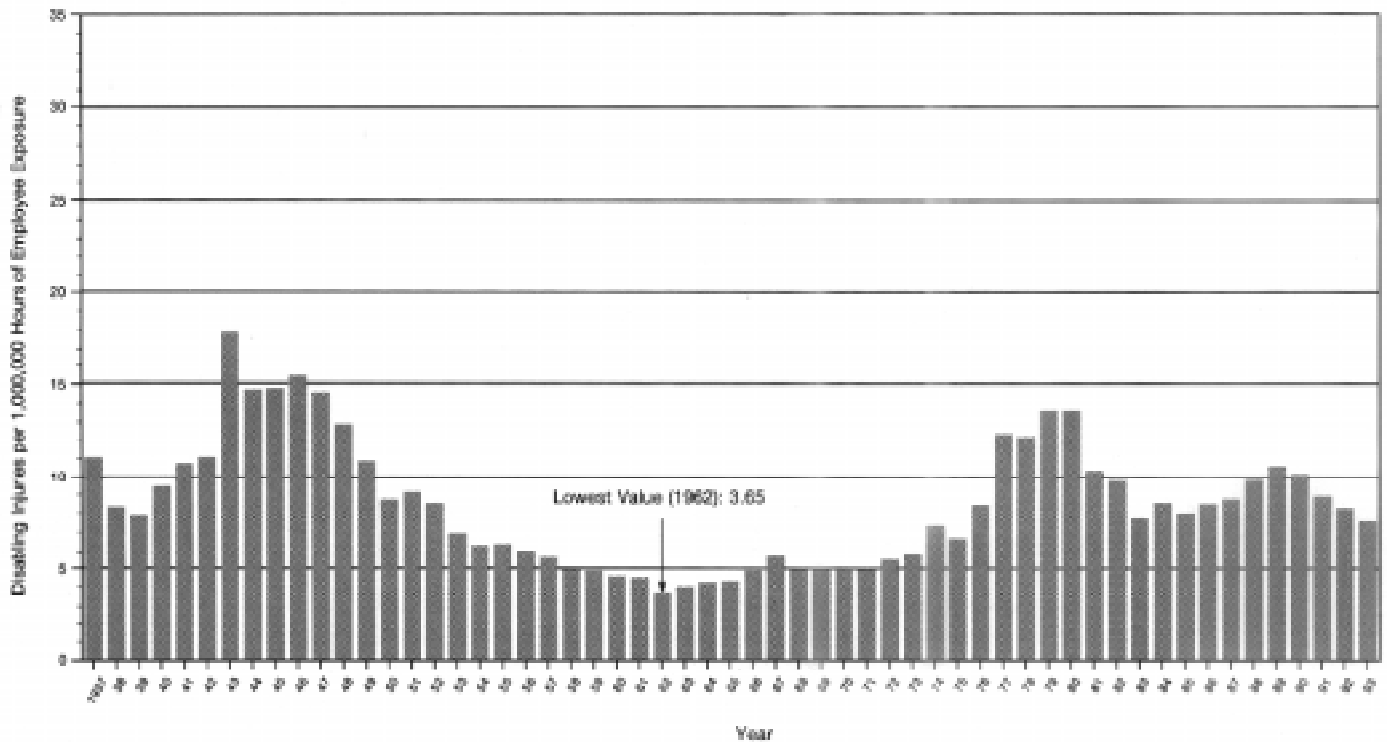
FIG. 1 - ACCIDENT FREQUENCY RATE - ALL INDUSTRIES



NOTES:

1. Accident Frequency Rate is defined as the number of disabling injuries per 1,000,000 hours of employee exposure.
2. Incidence Rate is defined as the number of recordable injury cases per 200,000 hours of employee exposure.
3. 1926-1976 Accident Frequency Rate (USAS Z16.1 - 1967)
4. Incidence Rate X 5 (ANSI Z16.4 - 1977)

FIG. 2 - ACCIDENT FREQUENCY RATE - MACHINERY



NOTES:

1. Accident Frequency Rate is defined as the number of disabling injuries per 1,000,000 hours of employee exposure.
2. Incidence Rate is defined as the number of recordable injury cases per 200,000 hours of employee exposure.
3. 1926-1976 Accident Frequency Rate (USAS Z16.1 - 1967)
4. Incidence Rate X 5 (ANSI Z16.4 - 1977)