Chapter III

THE CONCEPT OF SAFETY

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This chapter presents a discussion of contemporary concepts of safety and the evolution of the treatment of safety in the workplace.

The term "safety " has been defined as: "the state of being tree from danger or more practically the use of methods and devices that reduce, control role, or prevent accident s." That definition, however, does not provide the necessary explanation of the concept of safety. Two question must be considered in order to understand the concept.

- On what basis does society make judgments about the acceptable levels of safety?
- Who influences or **makes the determinations as to acceptable levels of safety?**

In order to place the discussion of these issues in the proper context, below is a brief historical review of safety problems and society's response to those problems.

Safety Problems. The introduction of power machinery in England in the 18th century brought to society a higher probability of accidents and personal injuries than it had ever had in the past. The new machinery had moving gears, cutting blades, and automatic power-operation which both enriched the human condition and presented new risks of injury. These risks of accident and injury were brought to the workplace and the home, as well as other environments. As technology has become a more integral part of our lives, so have the accompanying risks. Many of the accidental deaths in the United States, which have exceeded 100,000 each year since 1963, represent the human safety problem and its technological implication>.

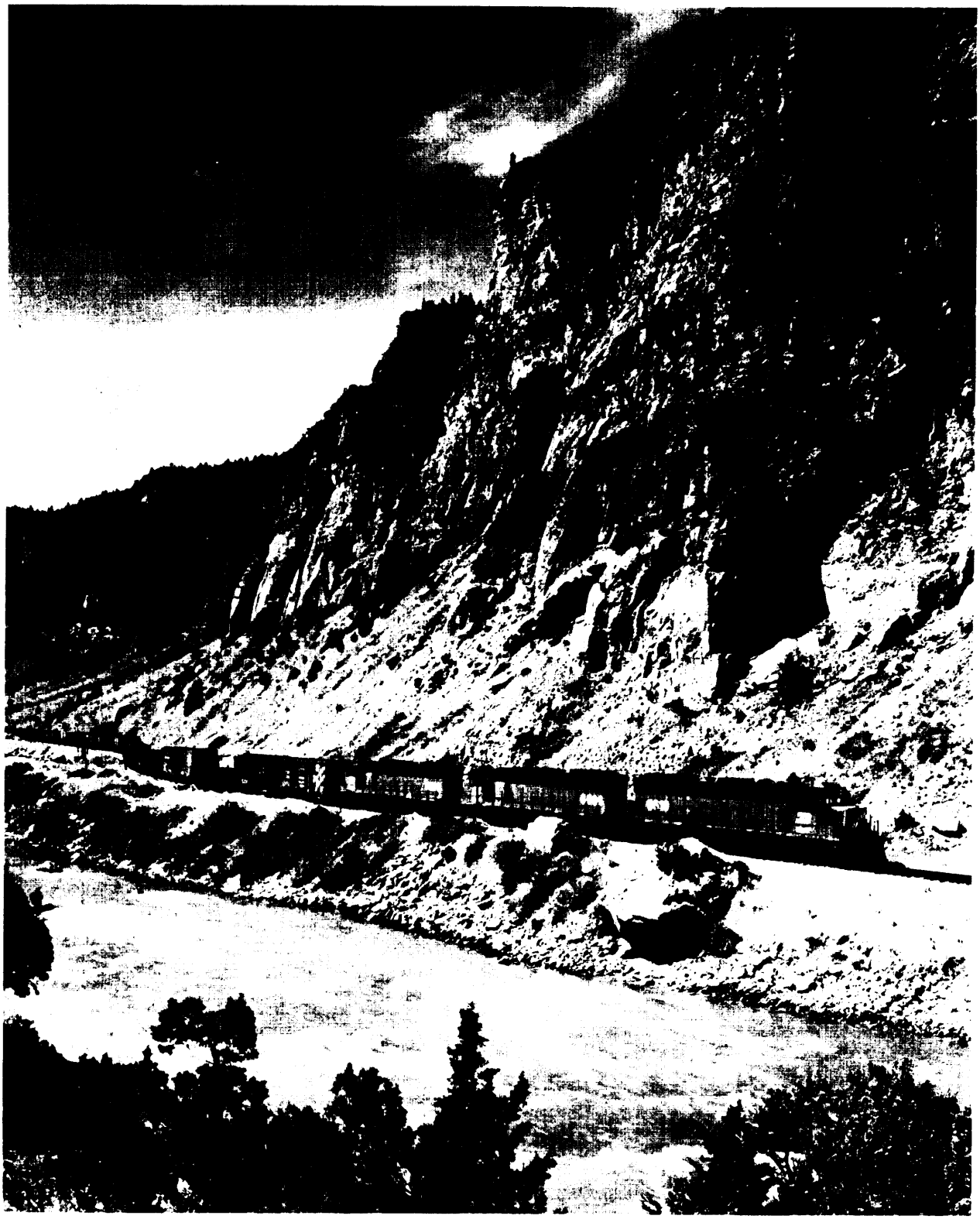
SOCIETY'S RESPONSES TO THE SAFETY PROBLEMS

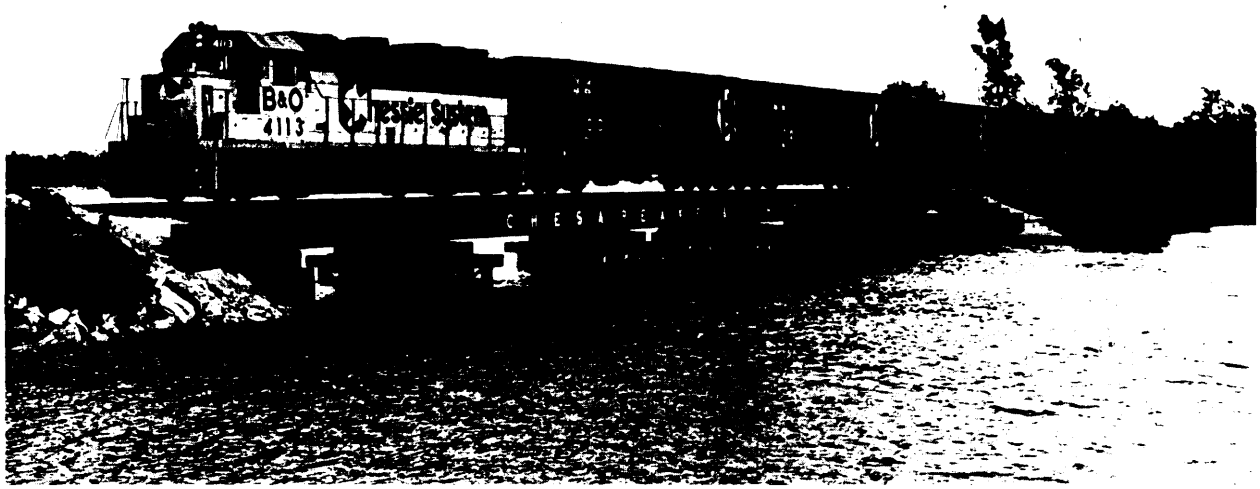
A review of history reveals that society has responded various ways to the problems of safety. Some of the responses were a function of the era; others a function of the nature 01 the safety problem. Society's first response to the safety problems of the workplace were under common law -- w'here the injured worker was prtected if the employer was proven *to* be at fault when the worker sued the employer. The next major rsponse of society was of the type of protection provided by the laws passed first in England and then in the United States requiring employers to Provide safe tools and in other respects maintain safe working conditions. And even then the three doctrines of the common law which supplied the employer with an adequate defense against suits brought for injured employees were:

1. The "felIow-servant" rule under Which an employer was not liable for an injury resulting from the actions (careless or negligent) of fellow employees:
2. "Contributory negligence" Which provided that the employer is not liable if the worker's own negligence contributed injury;
3. "Assumption of the risk" which included the theory that an employee accepted the customary risks of an occupatition when taking the job.

The next phase of activity relative to safety in the workplace was the passage of Workmen's Compensation Laws which placed a definite responsibility upon the employer, whether or

[1]William W. Lowrance, *Of Acceptable Risk*, William Kauffman, 1976, served as a primary resource for this discussion.





Railroad systems throughout the United States are vital to our Nation's supply network.

Photos Courtesy of Association of American Railroad

not negligence could be proven. Maryland was the first State to pass such a law in 1902.

Following passage of the workmen's compensation laws, there came a variety of other laws regulating safety in the industrial setting—such as the Occupational Safety and Health Act passed in **1970.** Society's primary responses to promoting domestic safety have been insurance programs, building and fire control codes, information and education. The history of society's response to the railroad safety problems will be discussed in chapter IV of this report. Safety has always been a consideration in railroad location, design, construction, and maintenance, although the success of these safety efforts has varied. Accidents and injuries associated with the operation of railroads have occurred for which private sector safety efforts have not sufficed. Hence, Government has intervened in railroad safety matters since 1893, with the passage of the Safety Appliances Act.

A review of the evolution of society's response to safety suggests the following:

- Human activity involves risks.
- Certain risks are acceptable and others unacceptable.
- Of the unacceptable risks, a portion can be reduced by technology, while another portion can be reduced by information and education. The balance is beyond the present state of the art.
- In some circumstances, where the marketplace does not reduce the risks sufficient to satisfy the needs and desires of the public, Government intervenes.

The basis for determining acceptable levels of safety and what interests are involved in the decision making process are discussed below.

ON WHAT BASIS DOES SOCIETY MAKE JUDGMENTS ABOUT THE ACCEPTABLE LEVELS OF SAFETY?

When the safety of a product or activity is in question, the risks from exposure have to be measured. The measurement is conducted by making the following inquiries: a) what are the conditions of exposure (who will be exposed, to what, and how)?; b) what can be the adverse effects?; and c) what will be the relationship between the exposure and the adverse effects (how much adverse effect results from how much exposure)? In deciding what are acceptable levels of safety, understanding the answers to the questions above is only the first step in the analysis. Next comes the important step of determining the risks, i.e., probability of harm and its severity (for example, how many people run the risk annually of being injured or killed at a highway grade-crossing). The analysis then requires the crucial step of judging safety or the acceptability of risks. This last step in the analysis is a normative, political activity, while the other explorations are more scientific. In judging safety or the acceptability of risks, Lowrance suggests the considerations which influence the decisions should include:

> The extent to which the action is voluntary or involuntary; whether the effect is immediate or delayed; whether alternatives exist; whether the risk is certain or not known; whether the action is essential or a luxury; whether the action is or is not occupation related; whether or not the hazard is common; whether the risk will be to average people or unusually sensitive people; whether the activity will be as intended; and whether the consequences are reversible or irreversible.

With information and analyses of risks, the decision process should move to a consideration of efficacy, costs, and the distribution of risks, benefits, and costs. In the analysis, efficacy, or the measure of the probability and intensity of

beneficial effects, is weighed against the risk or the probability and severity of adverse effects. What is included in the *cost* analysis is not universally agreed upon. It is not limited to financial burden, but can also include such intangibles as individual freedom. The matter of cost assessment raises the complex issue of the value of human life. A methodology dealing with the value of life and safety improvement in a form amenable to analysis using the conceptual apparatus of economic theory has been treated recently by M. W. Jones-Lee in *The Value of Life*. In determining the nature of the *distribution of risks, benefits, and costs* among the questions to be answered are: Who pays for safety solutions? Will those paying benefit? Will those at risk benefit?

What is suggested then is that once there is an understanding of safety problems (risks), the next step is the identification of alternative solutions and the selection of the solution which best addresses the problem, The selection that is made among the alternatives must be based on a weighing of their costs and benefits. Thus, it is necessary that methods of conduction cost/benefit analyses be developed and applied specifically for safety-related matters.

Decisions about safety in the future will continue to be based in part on risk, efficacy ,and the distribution of the hazards, benefits, and costs. But there may be additional considerations -considering such activities activities as changing patterns of governmental involvement will the railroads, changes in technology, the concern about the environmental impact, and the possibility of new types of hazardous materials.

WHO INFLUENCES OR MAKES THE DETERMINATIONS AS TO ACCEPTABLE LEVELS OF RISK?

"Acceptable levels of risk of accident or injury" decisions involve value choices and hence cannot be reduced to universals. Different people with different stakes in the decisions may come to different conclusions. The decisions per force are made by a variety of interests. The list of stakeholders in railroad safety matters includes: railroad management, railroad labor, suppliers, rail shippers. the general public (users and nonusers of the rail services), and Government at all levels. Government is included because it too has a stake in what safety decisions are made because those decisions affect its authority. All of the stakeholders are capable of influencing safety decisions i n varying degrees. Often the decisions are made through traditional marketplace operations. But often is the legal order that defines the particular factors that must be taken into account. The legal order is manifested through legislation, executive and administrative orders, and judicial decisions. Further, it is the legal order which from to time determines the relative weight to be accorded to various of the factors/bases discussed above.

WHAT CONCLUSIONS CAN BE DRAWN ABOUT THE CONCEPT OF RAIL SAFETY?

As is true of the concept of safety generally, the concept of rail safety varies with the time, the issue, the role of various stakeholders, and the status of technology and customary practice. The level of acceptable risks of accident and injury is on a continuum where public values and attitudes toward risks as well as benefits change. Fifty years ago society tolerated 2,568 fatalities associated with grade crossings. In 1972, a Department of Transportation report suggested the goal of an annual reduction in fatalities of 500 persons from an annual fatality rate of over 1,200. What influences have changed in the acceptable level of risks associated with grade-crossings? Consider the following:

Society has made a determination that the frequency and severity of injuries at the 1938 level and the frequency of fatalities are not now acceptable given:

a. the present technology
b. the cost of accidents and fatalities
c. the willingness of society to pay an additional price for a new solution to the problem.

This explains the concept of safety vis-a-vis grade-crossings. However, it can be said that the demand for railroad safety generally continues to evolve to higher levels.